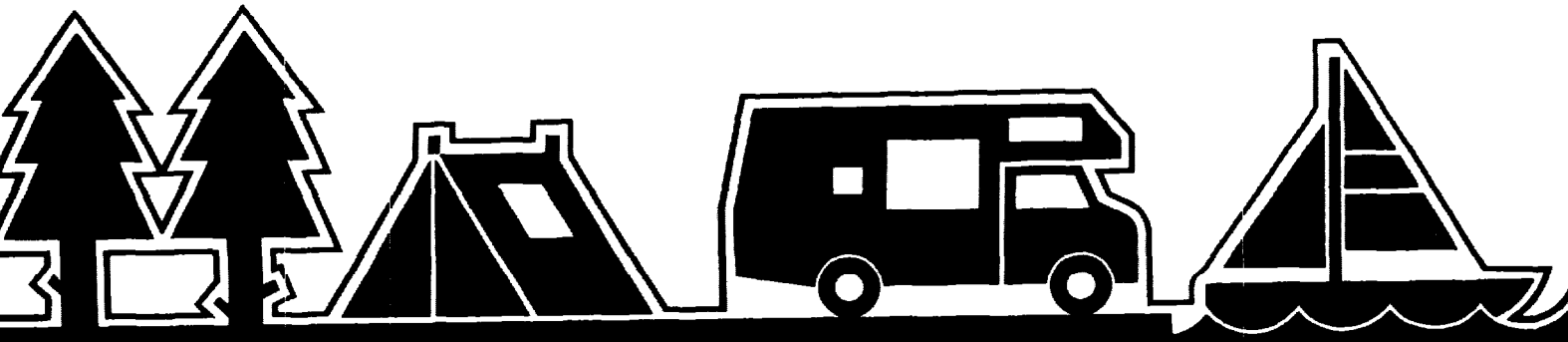
ROBIN
PORTABLE GENERATOR
R210 BRUSHLESS



Technical Data & Overhaul Instructions
SERVICE MANUAL

ISSUE EMD-GS0732

CONTENTS

RG-32
September-1995

SERVICE NEWS
Robin Generators

FUJI HEAVY INDUSTRIES LTD.
INDUSTRIAL PRODUCTS DIV.

MODEL	SUBJECT
R1210	Oil Sensor change

This Service News is to inform of the change of the oil sensor and wiring equipped with the ROBIN engine EY15 for R1210 generator set.

1. Purpose

To improve the performance of the oil sensor.

2. Main points of the modification

1) The oil level sensing mechanism of the oil sensor is changed from piezo-resonator type to potentiometer type.
2) The electric wiring and clamp are also changed.

3. Change of part number —— For the detail, refer to the attached figures.

New Parts set

NO.	Part Name	Part number	Q'ty
1.	Oil sensor CP.6	KS3-11015-01	1
2.	Wire 7 CP.	227-73107-01	1
3.	Clamp	056-60002-50	1

Current parts set

NO.	Part name	Part number	Q'ty
4.	Oil level sensor CP.	227-76035-01	1
5.	Wire 22 CP.	214-73122-01	1
6.	Clamp CP.	206-75501-01	1

Interchangeability

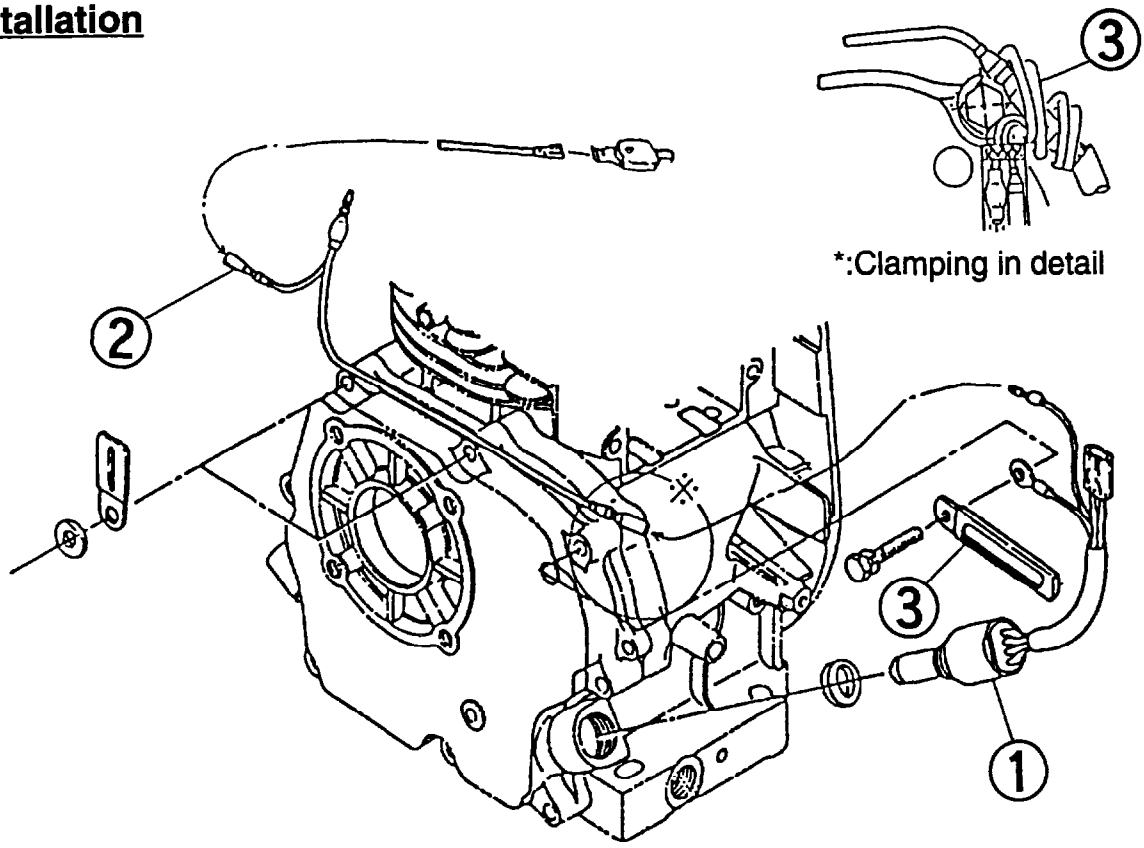
It is interchangeable only when the all parts are replaced as a set; that is to say, the current parts set (item NO.4 to 6) can be replaced with new parts set (item NO.1 to 3). However, there is no interchangeability for the individual part.

4. Execution

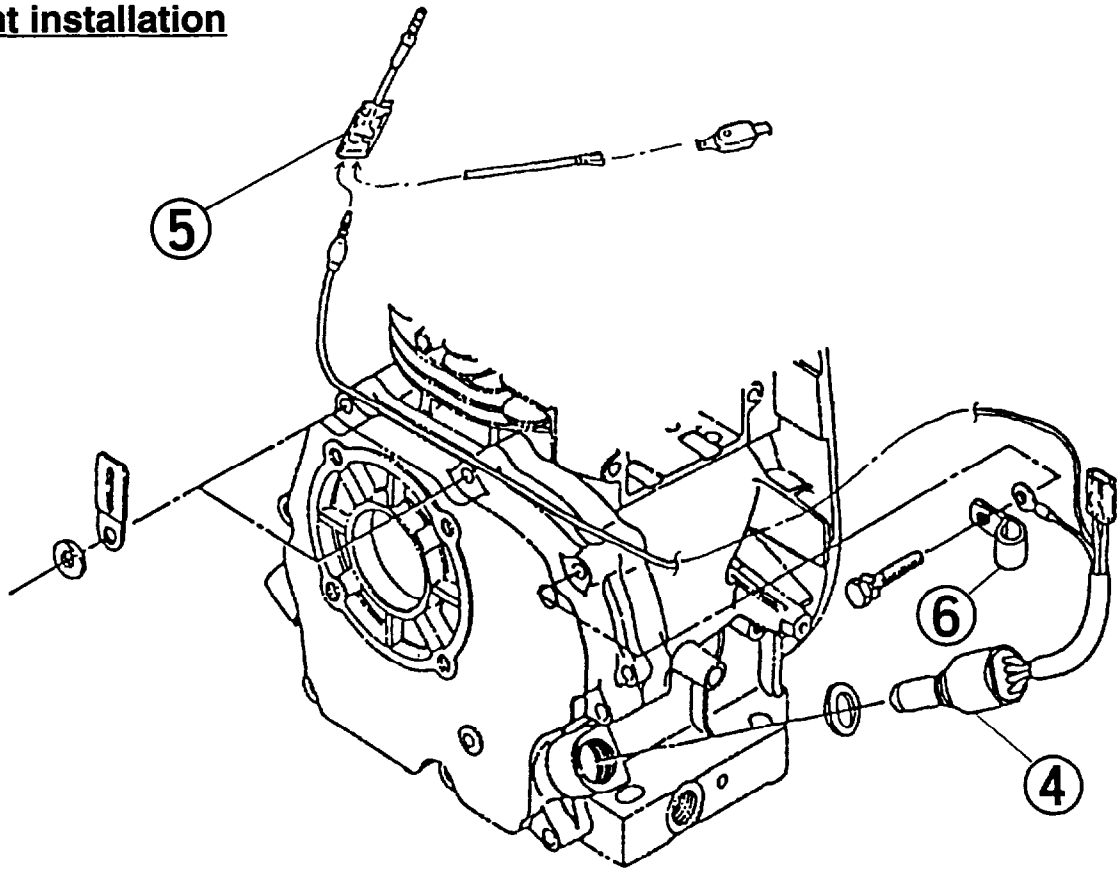
This oil sensor change is adopted to the new ROBIN generator set to be produced in and after September 1995.

Attachment (A); oil sensor installation change

New installation



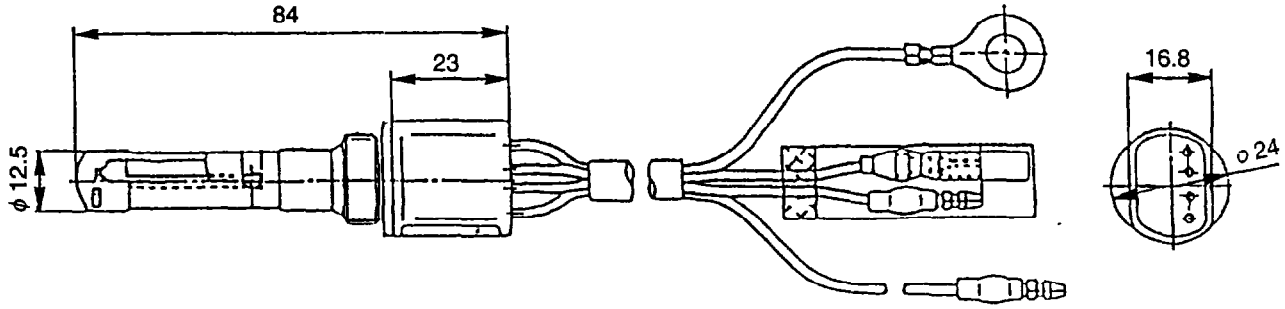
Current installation



Attachment (B)

1. Oil sensor change

New OIL SENSOR CP 6
KS3-11015-01



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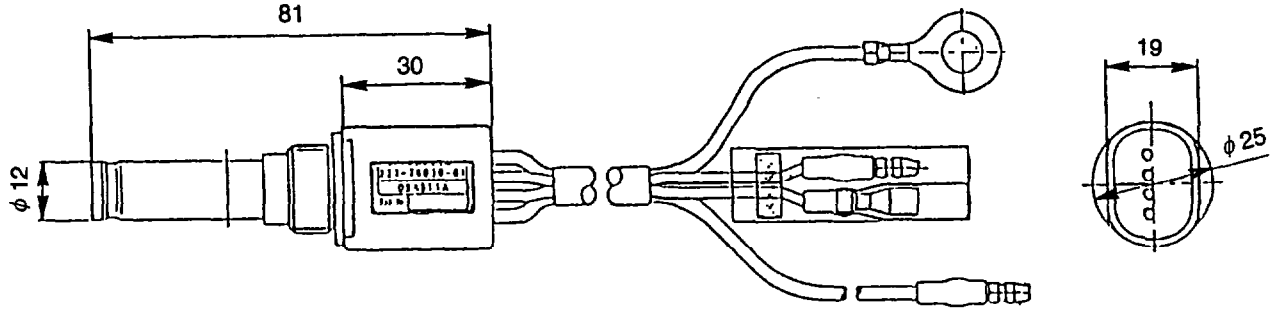
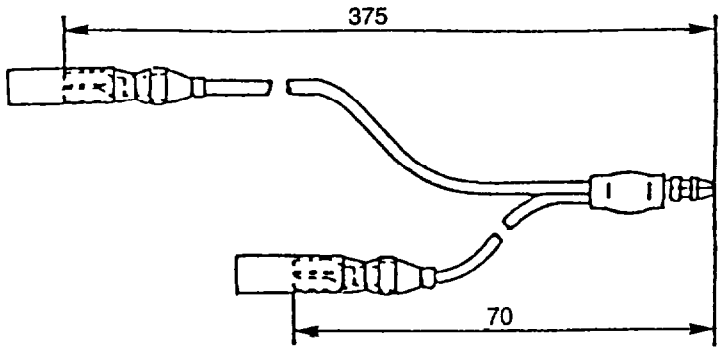
Current OIL LEVEL SENSOR CP
227-76035-01

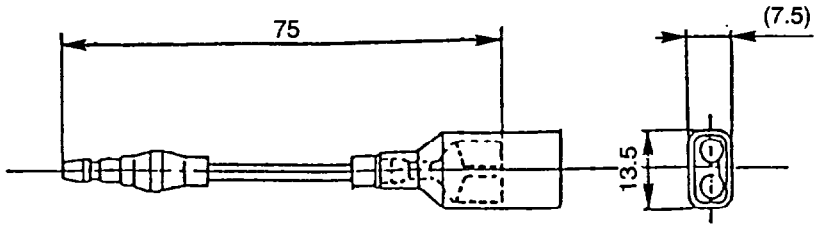


2. Electric wiring change

New WIRE 7 CP.
227-73107-01

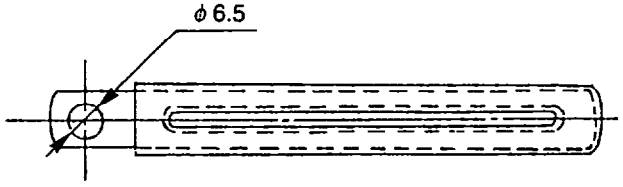


Current WIRE 22 CP.
214-73122-01

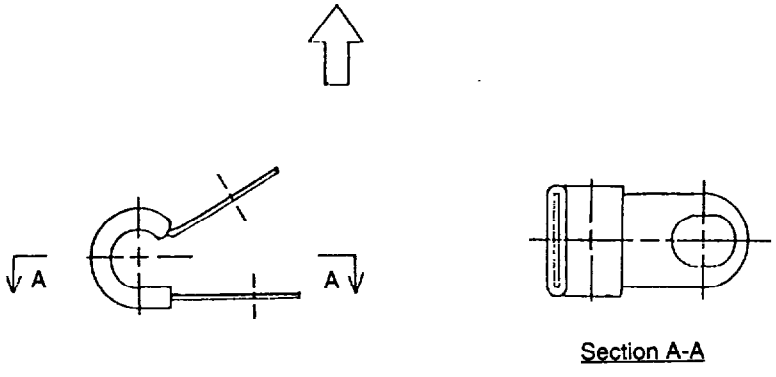


3. Clamp change

New CLAMP
056-60002-50



Current CLAMP CP.
206-75501-01

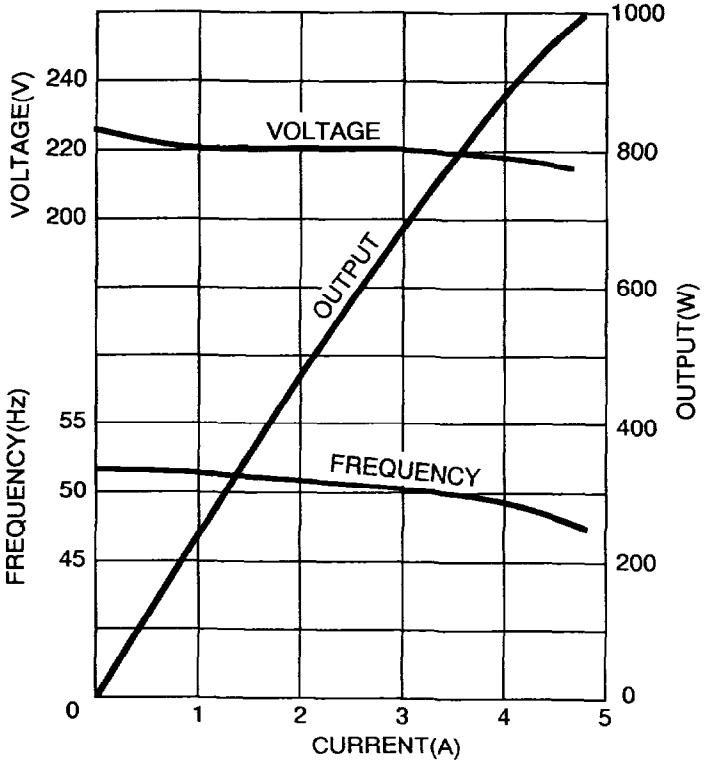


1. SPECIFICATIONS

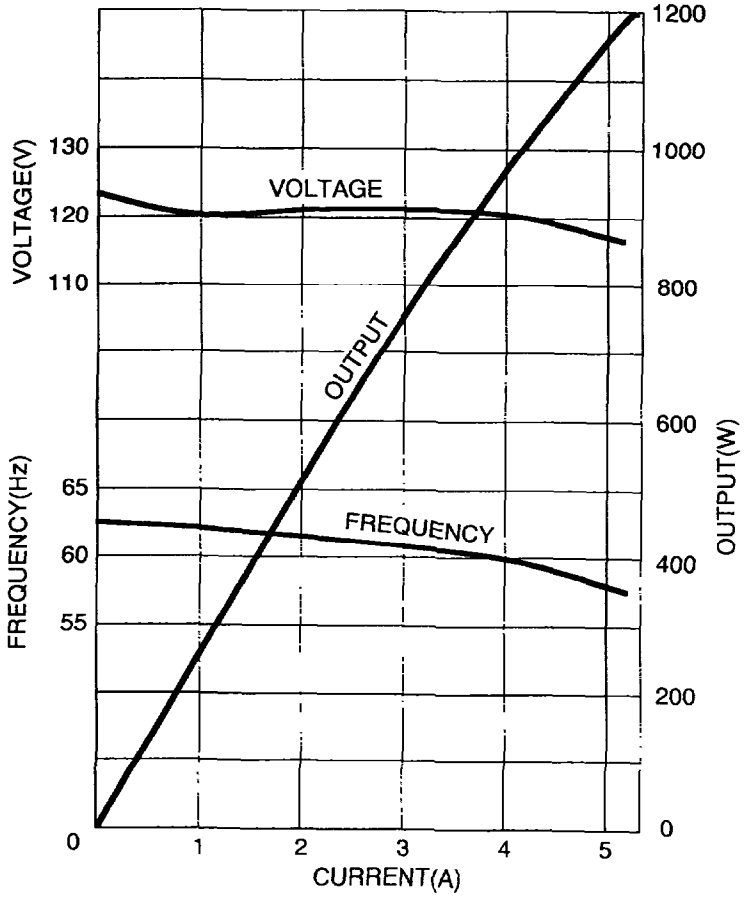
Generator	Type		Bushless, self-exciting, 2-pole, single phase, revolving field	
	Frequency		50 Hz	60 Hz
	AC Voltage (Rated current)		110V (7.3 A)	110V (9.1 A)
			220V (3.6 A)	120V (8.3 A)
			230V (3.5 A)	220V (4.5 A)
			240V (3.3 A)	————
	AC Output	Max.	1000 W	1200 W
		Rated	800 W	1000 W
	DC Output		12V – 8.3A (100 W)	
	Voltage regulation system		Condenser system	
Engine	Type		Forced air-cooled, 4-stroke, side valve, gasoline engine	
	Displacement		143 cc (6.73 cu. in)	
	Bore × Stroke		63 × 46 mm (2.48 × 1.81 in)	
	Fuel		Automotive gasoline	
	Fuel tank capacity		3.5 liters (0.9 U.S. gal)	
	Oil pan capacity		600 cc (1.3 U.S. pints)	
	Rated continuous operating hours		Approx. 4.3 hours (50 Hz) Approx. 3.5 hours (60 Hz)	
	Ignition system		Solid state ignition	
	Starting system		Recoil starter	
Dimensions (L × W × H)			486 × 288 × 410 mm (19.1 × 11.3 × 16.1 in.)	
Dry weight			27.5 kg (60.6 lbs.)	

2. PERFORMANCE CURVES

2-1 AC OUTPUT

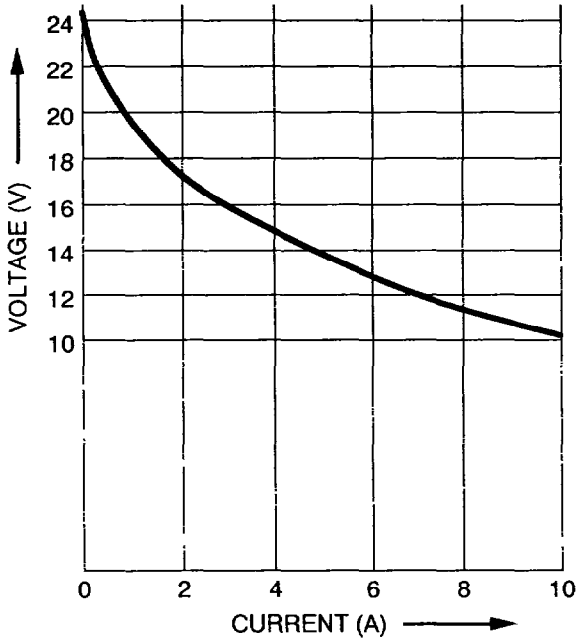


Output Max. ····· 1000W
Rated ····· 800W
Frequency ····· 50Hz
Voltage ····· 220V



Output Max. ····· 1200W
Rated ····· 1000W
Frequency ····· 60Hz
Voltage ····· 120V

2-2 DC OUTPUT



DC Voltage	12V
DC Ampere	8.3A
DC output	100W

The voltage curve shown in the left indicates the characteristic of DC output when charging a battery. The voltage may be decreased by 20% when the resistance load is applied.

3. FEATURES

3-1 BRUSHLESS ALTERNATOR

New brushless alternator has put an end to costly brush maintenance and down time.

3-2 CONDENSER VOLTAGE REGULATOR

Condenser voltage regulation ensures stable voltage output under all working conditions.

3-3 COMPACT, LIGHTWEIGHT, CARRYING EASE

As the new burshless alternator makes the Robin R1210 lightest in the class at 27.5 kgs, you can easily carry it around using the convenient carrying handle.

3-4 EASY OPERATION

One-touch engine control switch integrates engine on/off switch and choke lever. All controls are conveniently concentrated on the front panel.

3-5 LONG CONTINUOUS OPERATION

The large 3.5 liters fuel tank allows four hours of operation at 50Hz rated output.

3-6 MINIMAL MAINTENANCE

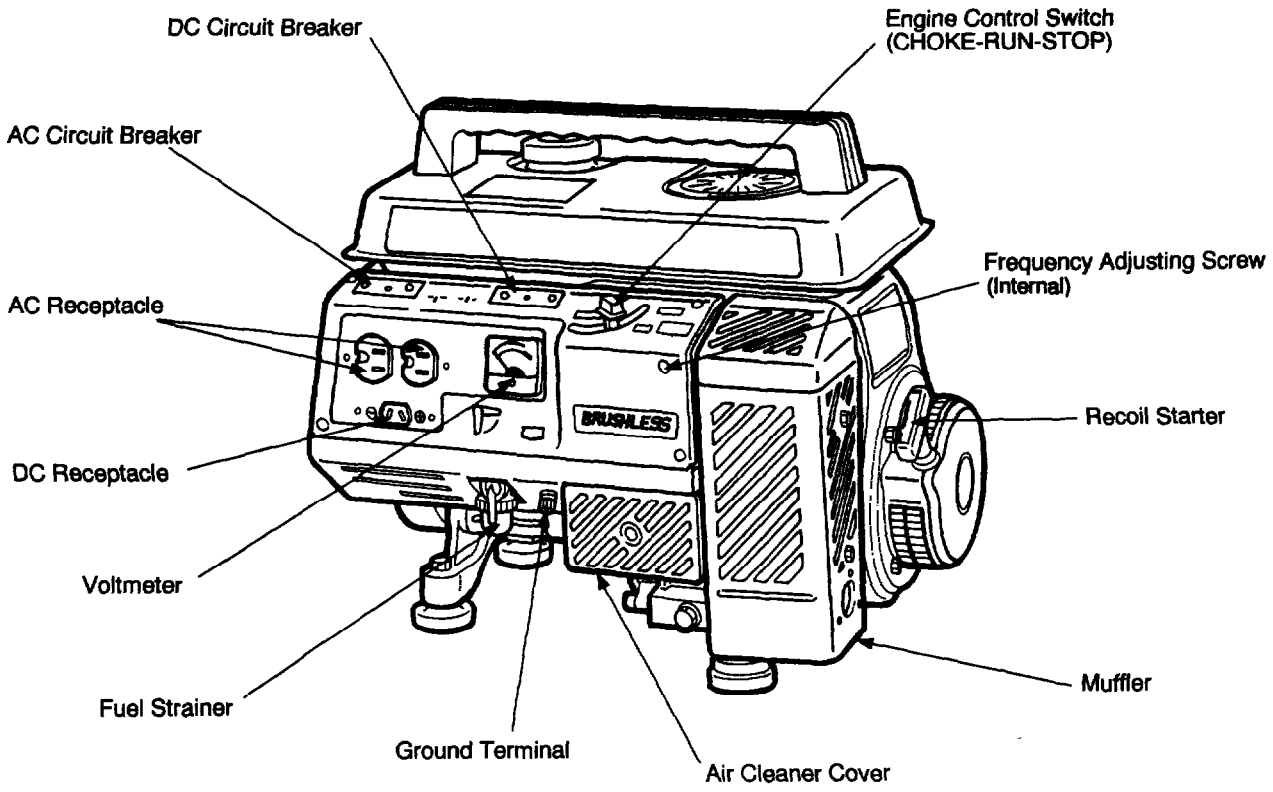
- Brushless alternator eliminates time consuming brush maintenance.
- Trouble-free condenser voltage regulation for greater dependability.
- No-fuse resettable circuit breakers.
- Electronic pointless ignition system for sure starts.

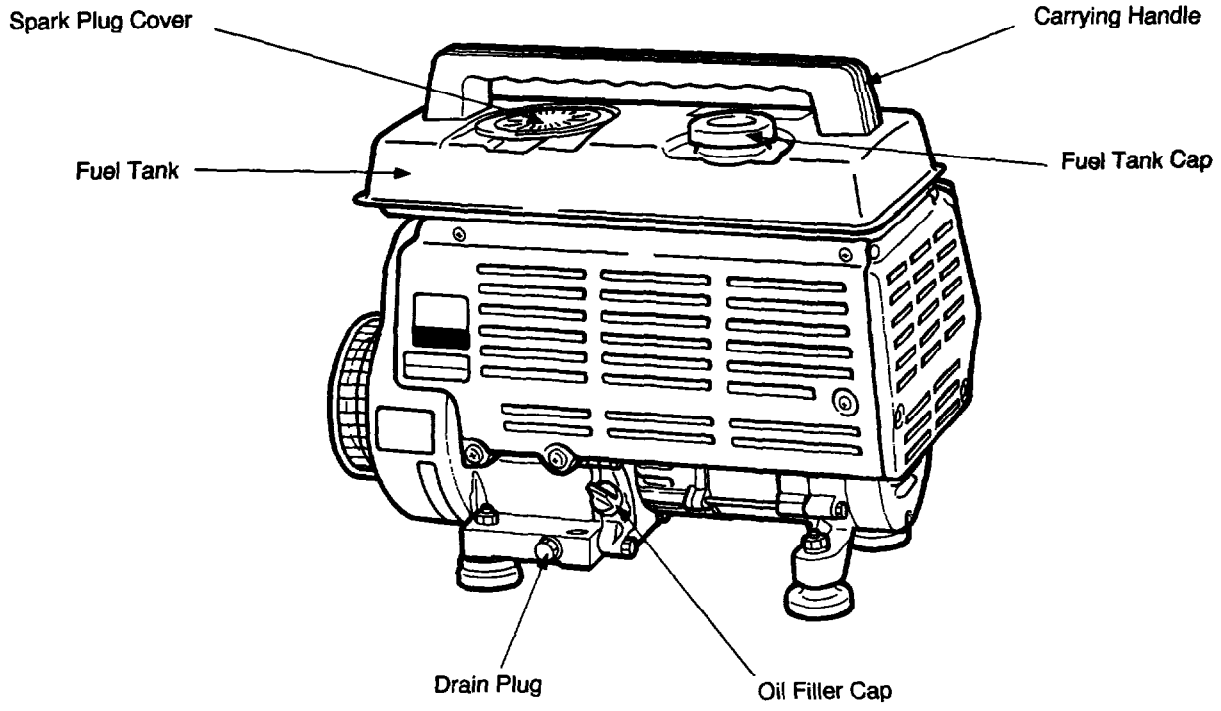
3-7 LONG LIFE DURABILITY

- Tough, heavy-duty Robin EY15 engine incorporates a cast iron cylinder liner, forged steel crankshaft and two main ball bearings for longer service life.
- The brushless alternator dose not have any expendable parts such as brushes and slip rings or fragile circuit board assuring trouble-free operation for longer service life.

4. GENERAL DESCRIPTION OF THE GENERATOR

4-1 EXTERNAL VIEW of GENERATOR

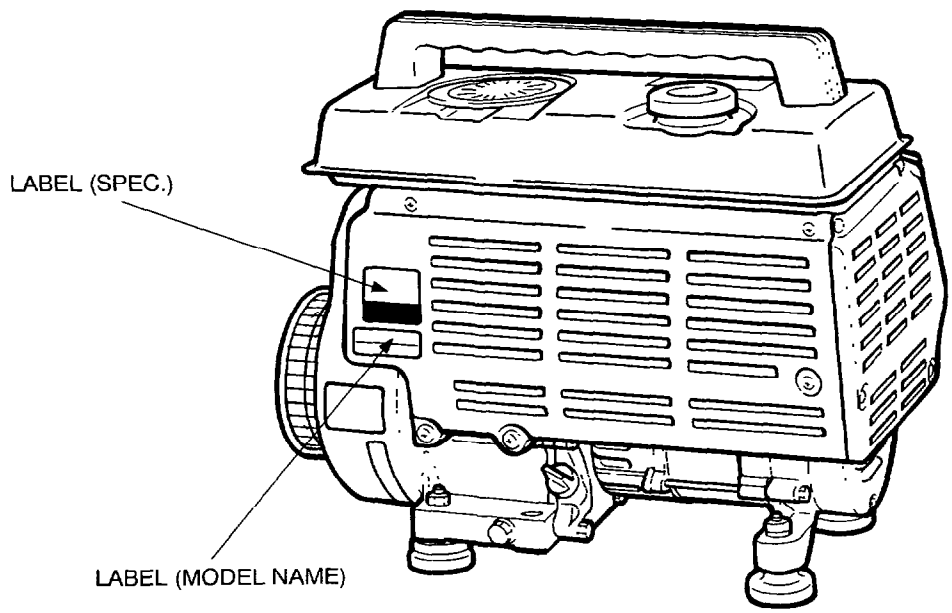




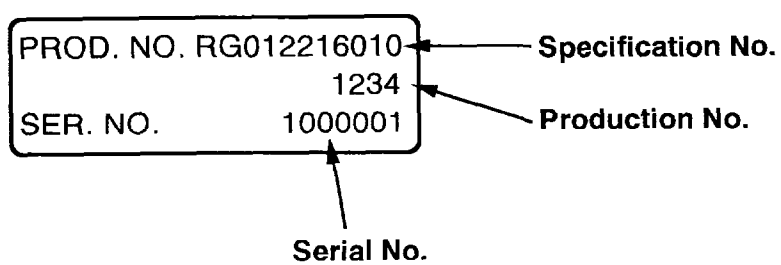
4-2 LOCATION of SERIAL NUMBER and SPECIFICATION NUMBER

Serial number and specification number are stamped on the LABEL(MODEL NAME)stuck on the rear cover.

NOTE: Always specify these numbers when inquiring about the generator or ordering spare parts in order to get correct parts and accurate service.



[Example]



5. CONSTRUCTION AND FUNCTION

5-1 CONSTRUCTION

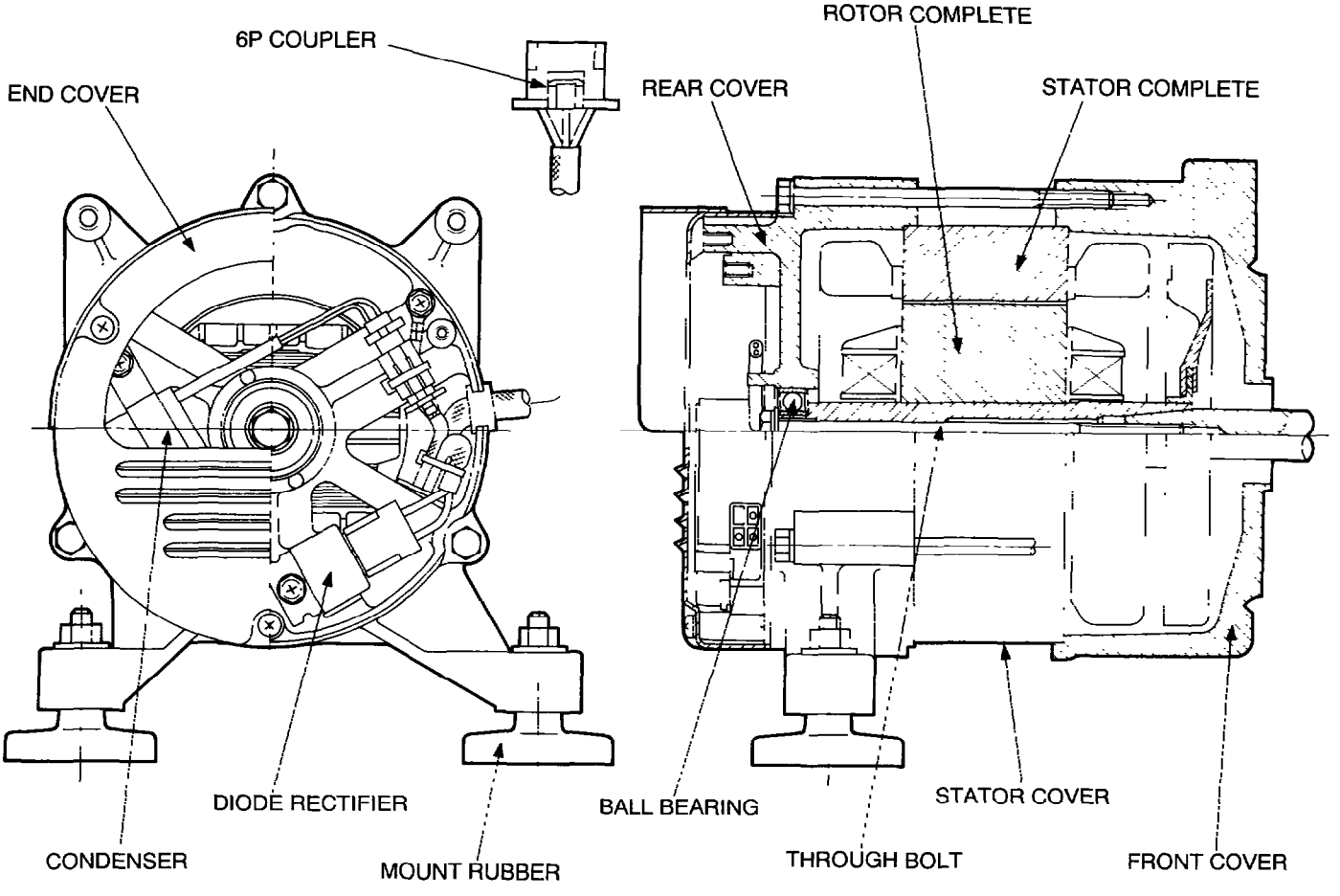


Fig. 5-1

5-2 FUNCTION

5-2-1 STATOR

The stator consists of a laminated silicon steel sheet core, a main coil and a condenser coil which are wound in the core slots.
The condenser coil excites the rotor field coil which generates AC voltage in the main coil.

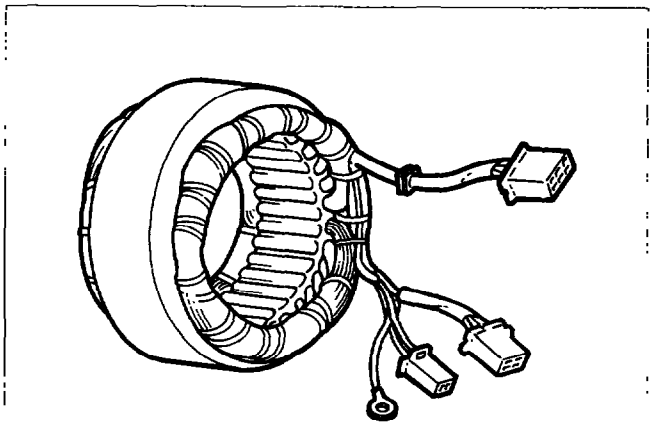


Fig. 5-2

5-2-2 CONDENSER

A condenser is mounted on the rear cover and is connected to the condenser coil which is wound on the stator. This condenser and condenser coil regulate the output voltage.

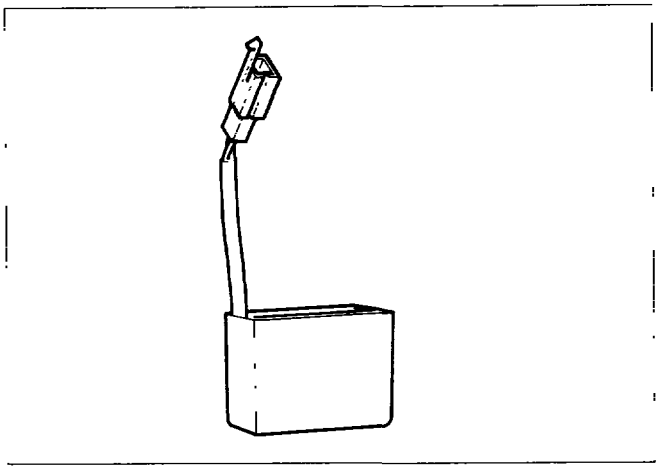


Fig. 5-3

5-2-3 ROTOR

The rotor consists of a laminated silicon steel sheet core and field coil which is wound over the core.
DC current in the field coil magnetizes the steel sheet core. Two permanent magnets are provided for the primary exciting action.
A cooling fan is pressure-fitted on the end of the rotor shaft to cool the coils, cores, rectifier, and other generator parts. (See Fig. 5-4)

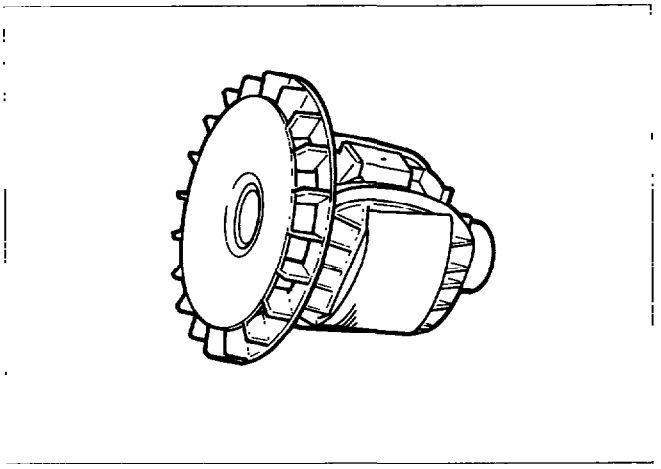


Fig. 5-4

A diode rectifier and resister are mounted inside of the insulator. (See Fig. 5-5)

Cooling air is sucked by the rotor fan through the slits of the rear cover and is expelled through the outlets of the front cover.

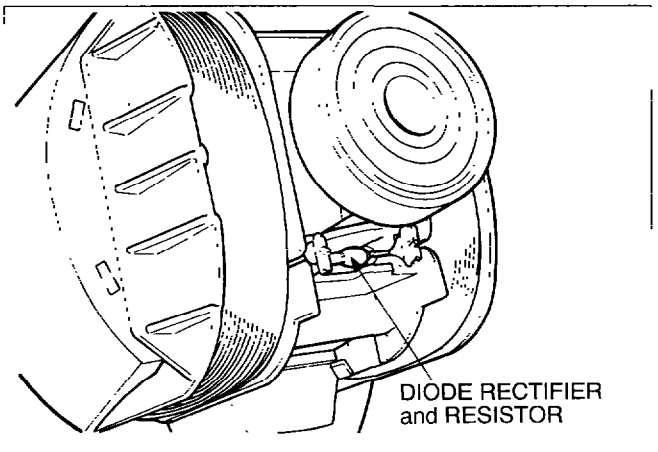


Fig. 5-5

5-2-4 CONTROL PANEL

The control panel has a double AC receptacle with a ground terminal, and a DC receptacle.
The voltmeter displays output voltage of the generator. The circuit breaker for AC and DC in the upper section of the control panel protects the generator from getting damages caused by overloading or defective appliance.

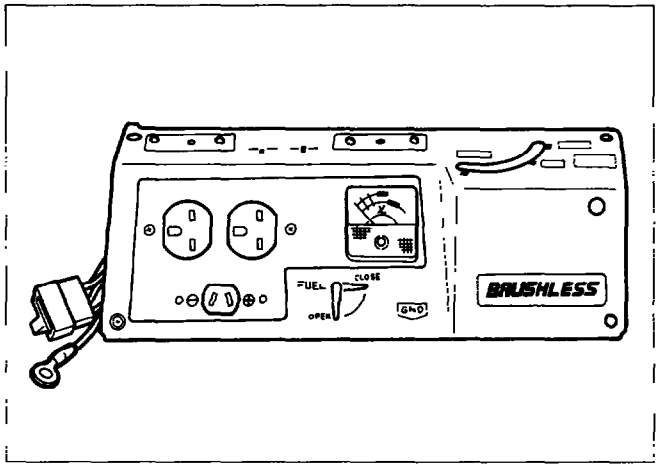


Fig. 5-6

5-3 DESCRIPTION of GENERATOR OPERATION

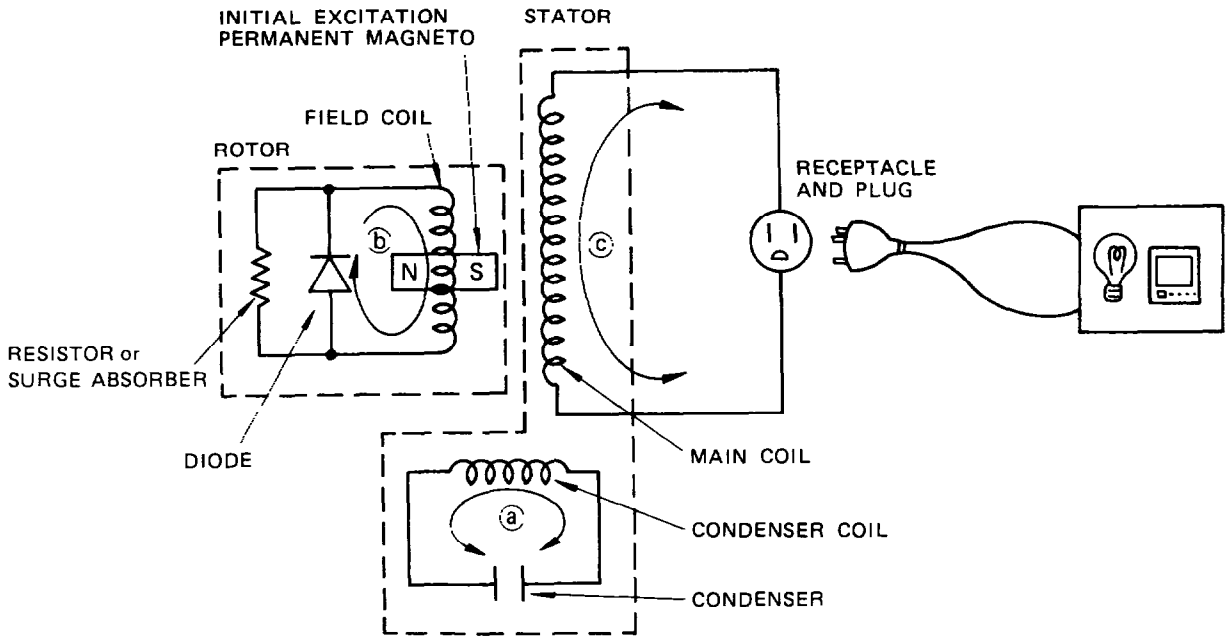


Fig. 5-7

5-3-1 GENERATION of NO-LOAD VOLTAGE

(1) When the generator starts running, the permanent magnet built-in to the rotor generates 3 to 6V of AC voltage in the main coil and condenser coil wound on the stator.

(2) As one or two condensers are connected to the condenser coil, the small voltage at the condenser coil generates a minute current ⓐ which flows through the condenser coil. At this time, a small flux is produced with which the magnetic force at the rotor's magnetic pole is intensified. When this magnetic force is intensified, the respective voltages in the main coil and condenser coil rise up.
As the current ⓐ increases, the magnetic flux at the rotor's magnetic pole increases further. Thus the voltages at the main coil and condenser coil keep rising by repeating this process.

(3) As AC current flows through the condenser coil, the density of magnetic flux in the rotor changes. This change of magnetic flux induces AC voltage in the field coil, and the diode rectifier in the field coil circuit rectifies this AC voltage into DC. Thus a DC current ⓑ flows through the field coil and magnetizes the rotor core to generate an output voltage in the main coil.

(4) When generator speed reaches 2700 to 2800 rpm (50Hz type) or 3000 to 3300 rpm (60Hz type), the current in the condenser coil and field coil increases rapidly.
This acts to stabilize the output voltage of each coils. If generator speed further increases to the rated value, the generator output voltage will reach to the rated value.

5-3-2 VOLTAGE FLUCTUATIONS UNDER LOAD

When the output current ⓒ flows through the main coil to the appliance, a magnetic flux is produced and serves to increase current ⓐ in the condenser coil. When current ⓐ increases, the density of magnetic flux across the rotor core rises. As a result, the current flowing in the field coil increases and the generator output voltage is prevented from decreasing.

5-3-3 DC OUTPUT

DC output is taken out from the DC coil and is fed to the diode stack (rectifier) where the output undergoes full-wave rectification and is then supplied to the load. The diode works to allow the current to flow in the direction ⓐ, but does not allow the current to flow in the direction ⓑ, as shown in Fig. 5-8-1.

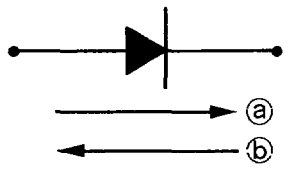


Fig. 5-8-1

Fig. 5-8-2 shows the DC output circuit of the generator. DC voltage is generated in the DC coil. When the voltage in **A** is higher than that in **B**, the current ⓒ flows in the direction shown in the figure, while no current flows between **CF** and **DE** because the current is cut off by the diodes **G4** and **G2**. On the contrary, when the voltage in **B** is higher than that in **A**, the current ⓓ flows in the direction as shown in the figure. No current flows between **CD** and **EF** because the current is cut off by the diodes **G1** and **G3**.

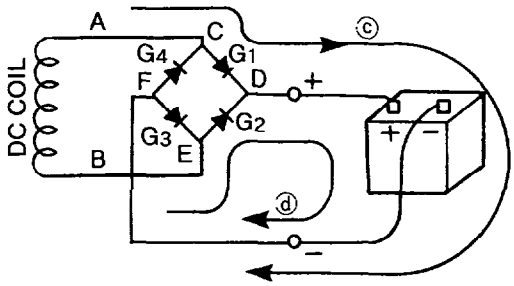


Fig. 5-8-2

As a result, the voltage generated at the output terminal has a wave form with two peaks in one cycle, as in the case of the output wave form shown in Fig. 5-8-3.

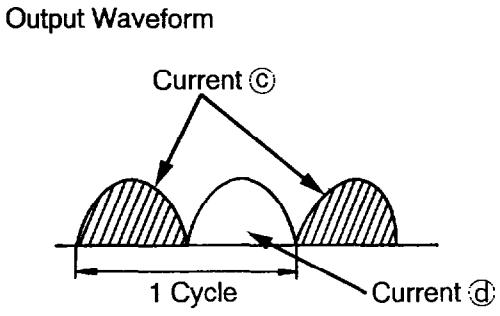


Fig. 5-8-3

CAUTION : Do not use DC and AC output simultaneously.
Due to a characteristic of the condenser voltage regulation, simultaneous use of DC and AC output creates voltage drop in DC output resulting in incapability for charging batteries.

6. SAFETY PRECAUTIONS

1. **Use extreme caution near fuel. A constant danger of explosion or fire exists.**

   Do not fill the fuel tank while the engine is running. Do not smoke or use open flame near the fuel tank. Be careful not to spill fuel when refueling. If spilt, wipe it and let dry before starting the engine.

2. **Do not place inflammable materials near the generator.**

   Be careful not to put fuel, matches, gunpowder, oily cloth, straw, and any other inflammables near the generator.

3. **Do not operate the generator in a room,cave or tunnel. Always operate in a well-ventilated area.**

   Otherwise the engine may overheat and also, the poisonous carbon monoxide contained in the exhaust gases will endanger human lives. Keep the generator at least 1 m (4 feet) away from structures or facilities during use.

4. **Operate the generator on a level surface.**

   If the generator is tilted or moved during use, there is a danger of fuel spillage and a chance that the generator may tip over.

5. **Do not operate with wet hands or in the rain.**

   Severe electric shock may occur. If the generator is wet by rain or snow, wipe it and thoroughly dry it before starting.
   Don't pour water over the generator directly nor wash it with water.
   If the generator is wet with water, the insulations will be adversely affected and may cause current leakage and electric shock.

6. **Do not connect the generator to the commercial power lines.**

   This may cause a short-circuit or damage to the generator.
   Never connect the generator to the existing house wiring. If connected, the generator will burn out when the commercial power source is recovered.

7. **Don't operate the generator with its cover removed.**

   The operator may be injured or suffer electric shock.

CAUTION; If the circuit breaker tripped off as a result of using an electrical appliance, the cause can be an overload or a short-circuit.
In such a case, stop operation immediately and carefully check the electrical appliance and plugs for faulty wiring.

7. RANGE OF APPLICATIONS

Generally, the power rating of an electrical appliance indicates the amount of work that can be done by it. The electric power required for operating an electrical appliance is not always equal to the output wattage of the appliance. The electrical appliances generally have a label showing their rated voltage, frequency, and power consumption (input wattage). The power consumption of an electrical appliance is the power necessary for using it. When using a generator for operating an electrical appliance,the power factor and starting wattage must be taken into consideration.
In order to determine the right size generator, it is necessary to add the total wattage of all appliances to be connected to the unit.
Refer to the followings to calculate the power consumption of each appliance or equipment by its type.

(1) Incandescent lamp, heater, etc. with a power factor of 1.0

Total power consumption must be equal to or less than the rated output of the generator.
Example: A rated 1000W generator can turn ten 100W incandescent lamps on.

(2) Fluorescent lamps,mercury lamps, etc. with a smaller power factor

Select a generator with a rated output equivalent to 1.2 to 2 times of the power consumption of the load.
Example: A 400W mercury lamp requires 600W to 700W power source to be turned on.
A rated 1000W generator can power one 400W mercury lamp.

NOTE 1: If a power factor correction capacitor is not applied to the mercury lamp or fluorescent lamp, the more power shall be required to drive those lamps.
A rated 1000W generator may unable to drive a 400W mercury lamp without power factor correction capacitors.

NOTE 2: Nominal wattage of the fluorescent lamp generally indicates the output wattage of the lamp.
Therefore, if the fluorescent lamp has no special indication as to the power consumption, efficiency should be taken into account as explained in item (5) on the following page.

(3) Motor driven tools and light electrical appliances

Generally the starting wattage of motor driven tools and light electrical appliances are 1.2 to 3 times lager than their running wattage.
Example: A rated 250W electric drill requires a 400W generator to start it.

(4) Initially loaded motor driven appliances such as water pumps,compressors,etc.

These appliances require large starting wattage which is 3 to 5 times of running wattage.
Example: A rated 900W compressor requires a 4500W generator to drive it.

NOTE 1: Motor-driven appliances require the aforementioned generator output only at the starting. Once their motors are started, the appliances consume about 1.2 to 2 times their rated power consumption so that the excess power generated by the generator can be used for other electrical appliances.

NOTE 2: Motor-driven appliances mentioned in items (3) and (4) vary in their required motor starting power depending on the kind of motor and start-up load. If it is difficult to determine the optimum generator capacity, select a generator with a larger capacity.

(5) Appliances without any indication as to power consumption

Some appliances have no indication as to power consumption; but instead the work load (output) is indicated. In such a case, power consumption is to be worked out according to the numerical formula mentioned below.

$$\frac{\text{(Output of electrical appliance)}}{\text{(Efficiency)}} = \text{(Power consumption)}$$

Efficiencies of some electrical appliances are as follows:

Single-phase motor ····· 0.6 ~ 0.75 ┐
Three-phase motor ····· 0.65 ~ 0.9 ┘ The smaller the motor, the lower the efficiency.
Fluorescent lamp ····· 0.7 ~ 0.8

Example 1: A 40W fluorescent lamp means that its luminous output is 40W. Its efficiency is 0.7 and accordingly, power consumption will be 40 ÷ 0.7= 57W. As explained in **Item(2)**, multiply this power consumption value of 57W by 1.2 ~ 2 and you will get the figure of the necessary capacity of a generator. In other words, a generator with a rated output of 1000Wcapacity can light nine to fourteen 40W fluorescent lamps.

Example 2: Generally speaking, a 400W motor means that its work load is 400W. Efficiency of this motor is 0.7 and power consumption will be 400 ÷ 0.7= 570W. When this motor is used for a motor-driven tool, the capacity of the generator should be multiplied by 1.2 to 3 and 570W as explained in the **item(3)**.

Electrical appliance	Applicable limit	
	50Hz	60Hz
Incandesent lamp, heater, etc.	approx.800W	approx.1000W
Fluorescent lamp, mercury lamp, etc.	approx. 550W	approx. 650W
Motor-driven tool, general-purpose motor, etc.	approx. 500W	approx. 600W
Water pump, compressor, etc.	approx. 250W	approx. 300W

Table 7-1

NOTES: Wiring between generator and electrical appliances

1. *Allowable current of cable*
   Use a cable with an allowable current that is larger than the rated input current of the load (electrical appliance). If the input current is larger than the allowable current of the cable used, the cable will become excessively heated and deteriorate the insulation, possibly burning it out.
   Table 7-2 shows cables and their allowable currents for your reference.
2. *Cable length*
   If a long cable is used, a voltage drop occurs due to the increased resistance in the conductors decreasing the input voltage to the load (electrical appliance). As a result, the load can be damaged.
   Table 7-2 shows voltage drops per 100 meters of cable.

Nominal cross section	A.W.G. Gauge No.	Allowable current	No. of strands/strand dia.	Resistance	Current Amp.							Voltage drop
mm^2	No.	A	No. / mm	Ω /100 m	1A	3A	5A	8A	10A	12A	15A	
0.75	18	7	30 / 0.18	2.477	2.5V	8V	12.5V	—	—	—	—	
1.27	16	12	50 / 0.18	1.486	1.5V	5V	7.5V	12V	15V	18V	—	
2.0	14	17	37 / 0.26	0.952	1V	3V	5V	8V	10V	12V	15V	
3.5	12 - 10	23	45 / 0.32	0.517	—	1.5V	2.5V	4V	5V	6.5V	7.5V	
5.5	10 ~ 8	25	70 / 0.32	0.332	—	1V	2V	2.5V	3.5V	4V	5V	

Table 7-2

Voltage drop indicates as $V = \frac{1}{100} \times R \times I \times \ell$

R means resistance (Ω /100 m) on the above table.
I means electric current through the wire (A).
ℓ means the length of the wire (m).
The length of wire indicates round length, it means twice the length from generator to electrical tools.

7-1 DC OUTPUT

NOTE : Do not use DC and AC output simultaneously.
Due to a characteristic of the condenser voltage regulation, simultaneous use of DC and AC output creates voltage drop in DC output resulting in incapability for charging batteries.

When the generator is employed to charge batteries, attentions should be paid to the specific gravity of electrolyte in the battery.

7-2-1 SPECIFIC GRAVITY OF BATTERY ELECTROLYTE

The specific gravity of electrolyte varies by temperature ; so it must be converted to the one at 20°C.

$$S_{20} = S_t + 0.0007\ (t\text{-}20)$$

where

S_{20} : The specific gravity at 20°C
S_t : Measured value
t : Temperature at the time of measurement (Electrolyte)

7-2-2 SPECIFIC GRAVITY OF BATTERY ELECTROLYTE AND CHARGING CONDITION

Specific gravity (20°C)	Charging condintion	Remarks
1,260	100	Charging is not necessary.
1,240	87	
1,220	75	Charging is necessary.
1,200	62	Immediate Charging is necessary.
1,180	50	
1,160	37	
1,140	25	

Table 7-3

7-2-3 BATTERY CAPACITY

The battery capacity is expressed in the unit of AH (ampere-hour). One AH stands for the capacity capable of one ampere current for one hour.

8. MEASURING PROCEDURES

8-1 MEASURING INSTRUMENTS

8-1-1 "Dr. ROBIN" GENERATOR TESTER

The "Dr. Robin"generator tester is exclusively designed for fast, easy diagnosis and repair of Robin generators.

The "Dr. Robin" has the following features:

(1) Functions of voltmeter, frequency meter, megger tester, capacitance meter and circuit tester are combined in one unit.
(2) Fast and easy readout by digital indicator.
(3) Built-in automatic battery checker indicates the time to change batteries.
(4) Tester and accessories are installed in a handy, sturdy case for easy carrying.

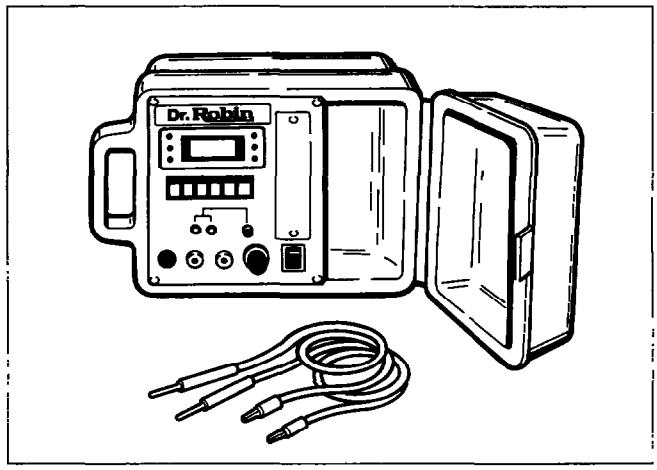


Fig. 8-1

- **SPECIFICATIONS**

Model		Dr. Robin
Part Number		388-47565-08
Measuring Range	Voltage	0~500V AC
	Frequency	25~70Hz
	Resistance	0.1~1,999 Ω
	Condenser Capacity	10~100 μF
	Insulation Resistance	3MΩ
Circuit Protector		Fuse
Power Source		2 × 6F44P (006P) Dry Cell Battery
Accessories		Test leads with needle probes · · · 1 set Test leads with jack plugs · · · · · · 1 set
Dimensions (L × W × H)		285 mm×200 mm×110 mm
Weight		1.6kg

Table 8-1

The "Dr. Robin"generator tester can be ordered from Robin generator distributors by the following part number.

Dr. Robin Part Number : 388-47565-08

If you do not have a "Dr. Robin"generator tester,use the instruments described in the following section for checking generator parts.

8-1-2 INSTRUMENTS

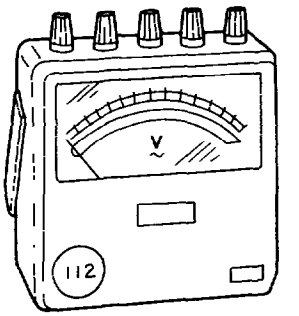
(1) VOLTMETER

AC voltmeter is necessary. The approximate AC voltage ranges of the voltmeters to be used for various types of generators are as follows:

0 to 150V: Type with an output voltage of 110 or 120V

0 to 300V: Type with an output voltage of 220, 230 or 240V

0 to 150V, 0 to 330V: Dual voltage type

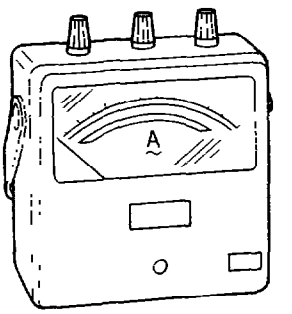


For AC

Fig. 8-2

(2) AMMETERS

AC ammeter is necessary. An AC ammeter with a range that can be changed according to the current rating of a given generator is most desirable. (About 10A, 20A, 100A)



For AC

Fig. 8-3

(3) FREQUENCY METER

Frequency range : About 45 to 65Hz

NOTE: Be careful of the frequency meter's input voltage range.

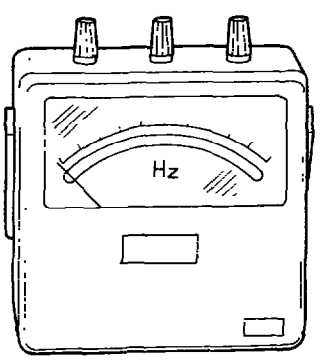


Fig. 8-4

(4) CIRCUIT TESTER

This circuit tester is used for measuring resistance, etc.

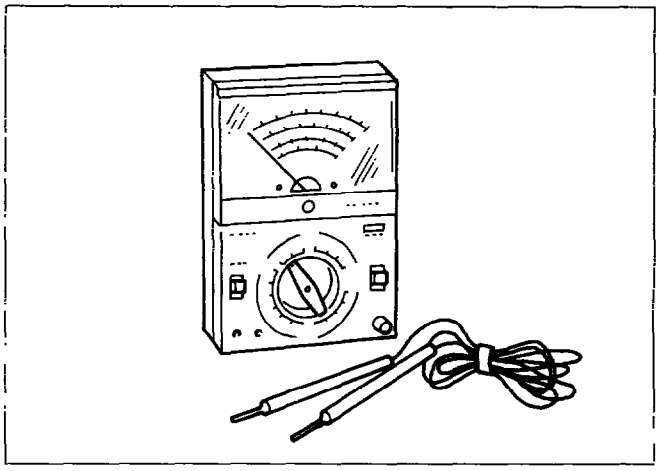


Fig. 8-5

(5) MEGGER TESTER

Used for measuring generator insulation resistance.

Select one with testing voltage range of 500V.

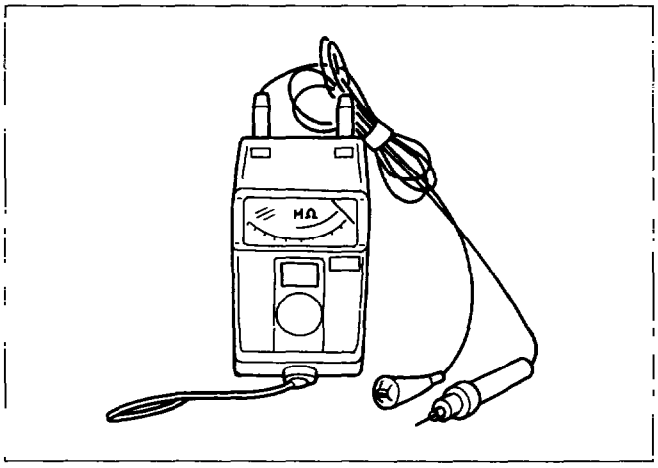


Fig. 8-6

(6) TACHOMETER

Use the contact-less type tachometer.

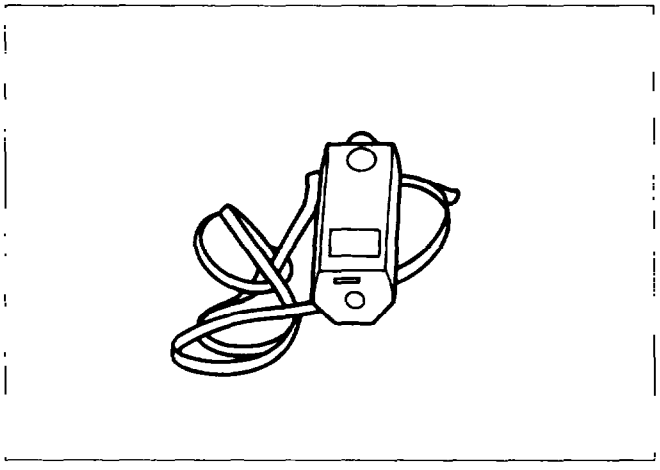


Fig. 8-7

8-2 AC OUTPUT MEASURING

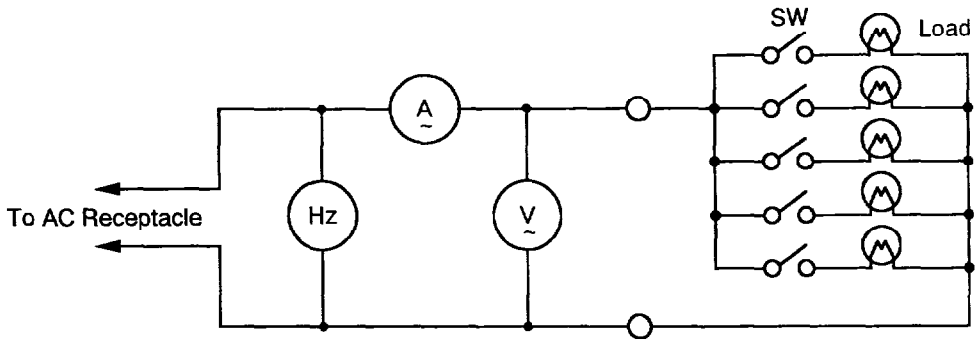


Fig. 8-8

Measurement is executed with the circuit as shown in Fig. 8-8. An electric heater or an incandescent lamp with a power factor of 1.0 is suitable as a load for the generator. When the AC output measured at the rated load and rated speed is confirmed to be within the voltage range specified in the table below, the AC output is normal.

Rated voltage	110V	120V	220V	240V
Voltage range	107~119V	117~130V	215~238V	235~260V

Table 8-2

8-3 DC OUTPUT MEASURING

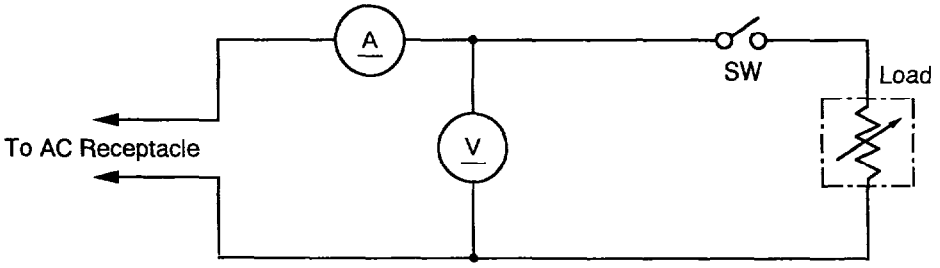


Fig. 8-9

Measurement of DC output is executed with the switch turned ON while the current is regulated at 8.3A by adjusting the load to the generator. If the voltage is within the range from 10V to 14V, the voltage output is normal.

Note : If a battery is connected as a load to the generator, the DC output voltage will increase by approximately 1 to 2V. Therefore, carefully observe the electrolyte level and do not overcharge the battery.

8-4 MEASURING INSULATION RESISTANCE

Use a "Dr. Robin"generator tester in megger tester mode or use a megger tester to check the insulation resistance. Connect a megger tester to one of receptacle output terminals and the ground terminal, then measure the insulation resistance. An insulation resistance of 1 megohm or more is normal. (The original insulation resistance at the time of shipment from the factory is 10 megohm or more.)

If it is less than 1 megohm, disassemble the generator and measure the insulation resistance of the stator, rotor and control panel individually.

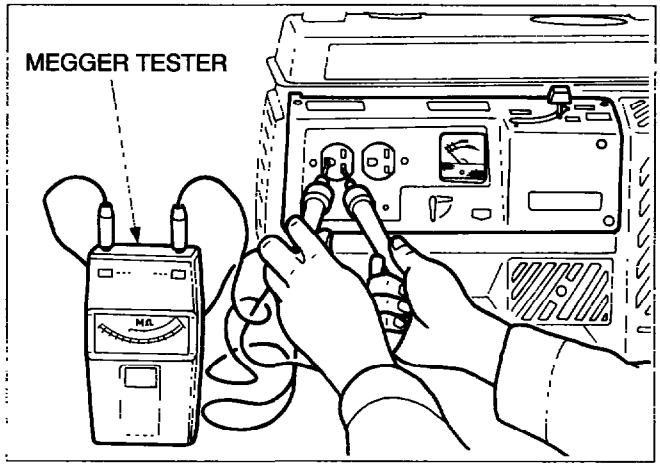


Fig. 8-10

• STATOR

(1) Measure the insulation resistance between BROWN lead and the core.
(2) Measure the insulation resistance between YELLOW lead and the core.
(3) Measure the insulation resistance between BLACK lead and the core.

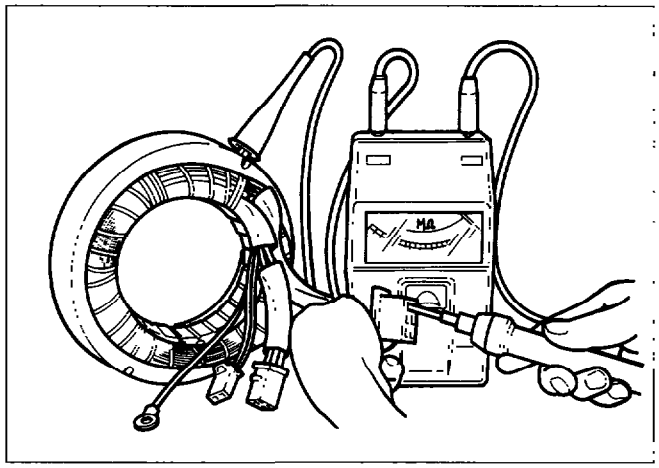


Fig. 8-11

• ROTOR

Measure the insulation across one of the soldered terminals of the rotor and the core.

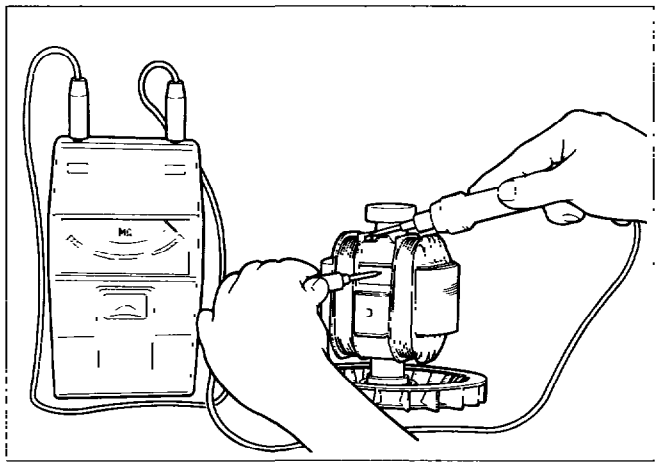


Fig. 8-12

● **CONTROL PANEL**

Measure the insulation resistances between the live parts and the grounded parts.

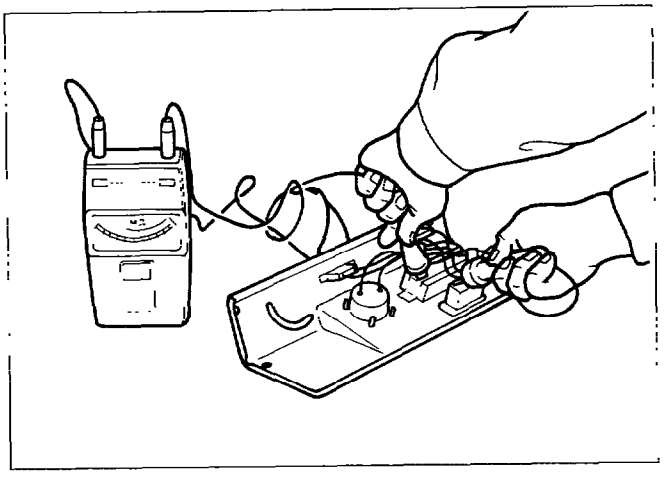


Fig. 8-13

Any part where the insulation resistance is less than 1MΩ has faulty insulation, and may cause electric leakage and electric shock.
Replace the faulty part.

9. CHECKING FUNCTIONAL MEMBERS

9-1 CONTROL PANEL

9-1-1 AC RECEPTACLES

Using a "Dr. Robin"or a circuit tester, check continuity between the two terminals at the rear of the AC receptacles while the receptacle is mounted on the control panel. When continuity is found between the output terminals of the receptacle with a wire connected across these terminals, the AC receptacle is normal. When the wire is removed and no continuity is found between these terminals, the receptacles are also normal.

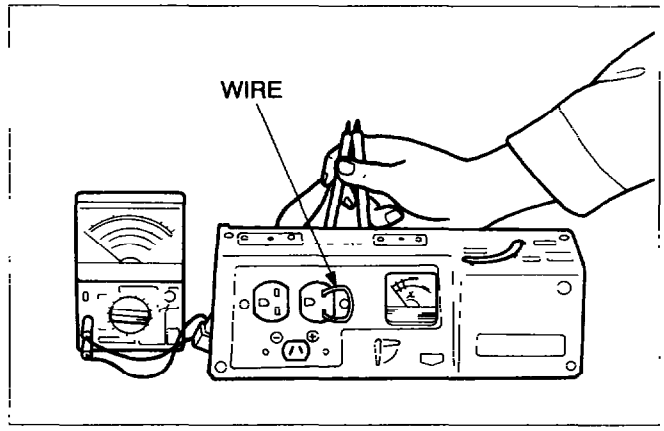


Fig. 9-1A

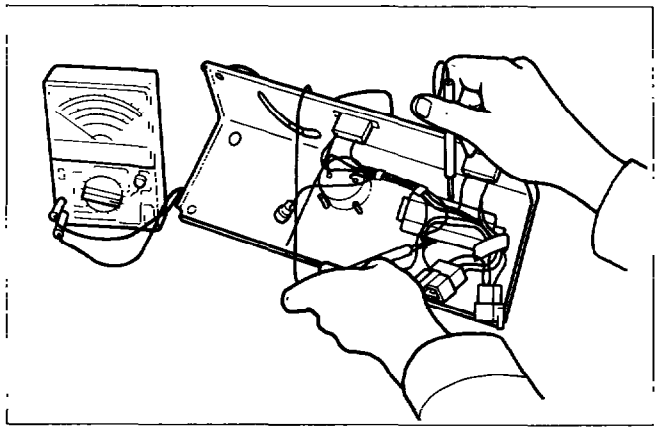


Fig. 9-1B

9-1-2 DC RECEPTACLE

Check continuity between the DC terminals at the rear of the receptacle using a circuit tester, under the condition that the receptacle is mounted on the control panel.

When continuity between the DC terminals of the receptacle is confirmed with a wire connected across the terminals, and is not confirmed if the wire is removed, the DC receptacle is normal.

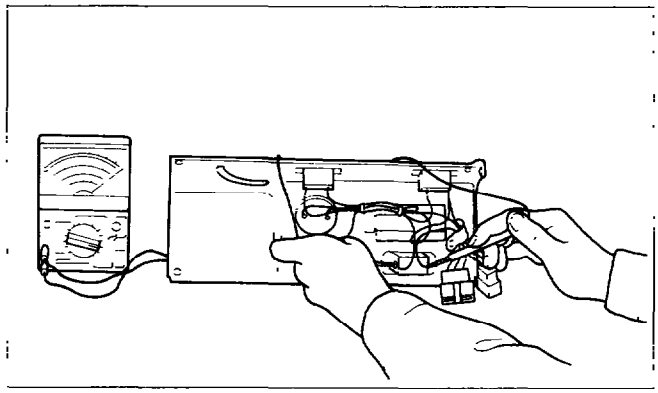


Fig. 9-2

9-1-3 CIRCUIT BREAKER

Check continuity between the two terminals at the rear side of the circuit breaker using a circuit tester while it is mounted on the control panel.
If continuity is confirmed when the breaker is ON, and no continuity is confirmed when the breaker is OFF, the circuit breaker is normal.

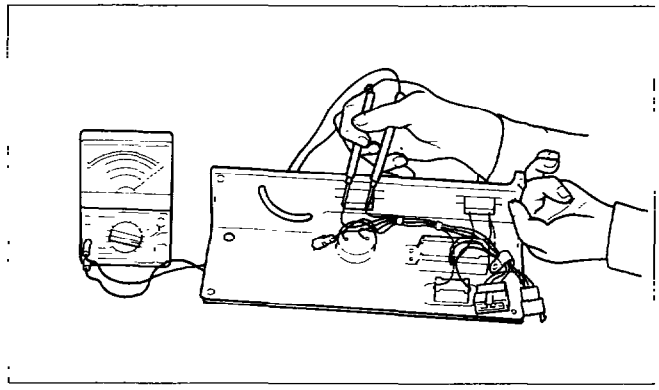


Fig. 9-3

9-1-4 VOLTMETER

Check the voltmeter if it operates correctly by applying specified voltage. Voltmeters cannot be checked with a circuit tester because its internal resistance is too large.

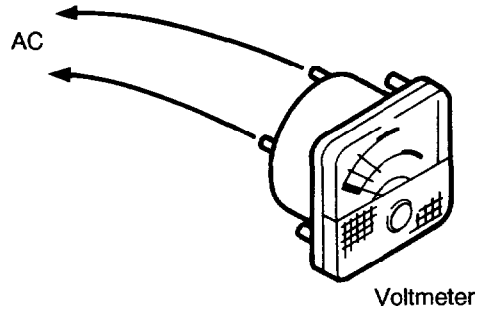


Fig. 9-4

9-2 STATOR

Disengage connectors on the wires from stator and check the resistance between wires with a "Dr. Robin" or a circuit tester referring to the following table.

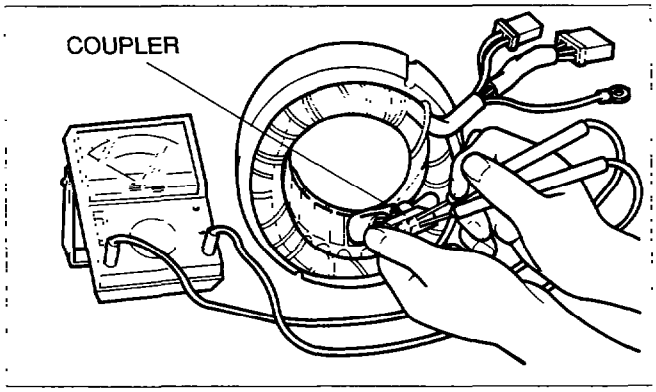


Fig. 9-5

(R×1 Ω ±10%)

Specification		AC Winding	DC Winding	Condenser Winging
Hz	Voltage	Brown / White	Yellow / Red	Black / Black
50	110V	1.7 Ω	0.84 Ω	4.9 Ω
	220V	6.3 Ω		
	220V (VDE spec.)	7.3 Ω	1.0 Ω	
	240V	8.1 Ω	0.84 Ω	
60	110V	1.0 Ω	0.56 Ω	4.2 Ω
	120V	1.3 Ω		
	220V	4.0 Ω		
	240V	5.0 Ω		

Table 9-1

NOTE: If the circuit tester is not sufficiently accurate,it may not show the values given and may give erroneous readings.
Erroneous reading will also occur when there is a wide variation of resistance among coil windings or when measurement is performed at ambient temperatures different from 20°C(68°F).

9-3 ROTOR

1) Using the "Dr. Robin"or a circuit tester, measure the resistance of the field coil. (See Fig. 9-6.)

(R × 1Ω ± 10%)

Resistance
8.5 Ω

NOTE 1: Because a diode is soldered to the coil ends at the terminals, resistance may be measured only when tester probes touch the terminals in one combination of polarity. Therefore, if no resistance reading appears, try checking in reverse polarity.

NOTE 2: If the circuit tester is not sufficiently accurate, it may not show the values given and may give erroneous readings.
Erroneous reading will also occur when there is a wide variation of resistance among coil windings or when measurement is performed at ambient temperatures different from 20°C(68°F).

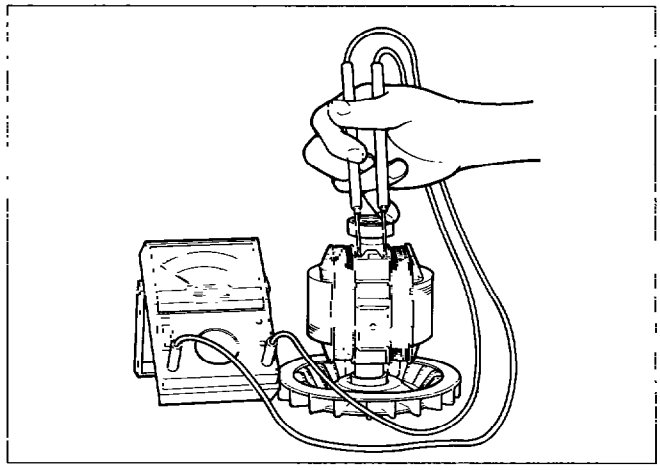


Fig. 9-6

2) Measure the resistance of the resister.

Normal resistance
15 KΩ

3) Measure the resistance of the diode.

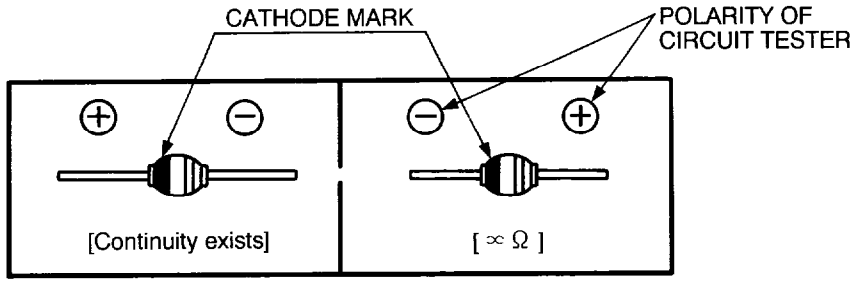


Fig. 9-7

9-4 CONDENSER

■ Use a "Dr. Robin" in capacitance meter mode to check the capacity of condensers. (See Fig. 9-8.)

NOTE: Be sure to discharge condensers by shorting condenser leads each other before checking their capacitance,or the accurate reading cannot be obtained.

Normal Capacity of Condenser
10 μF

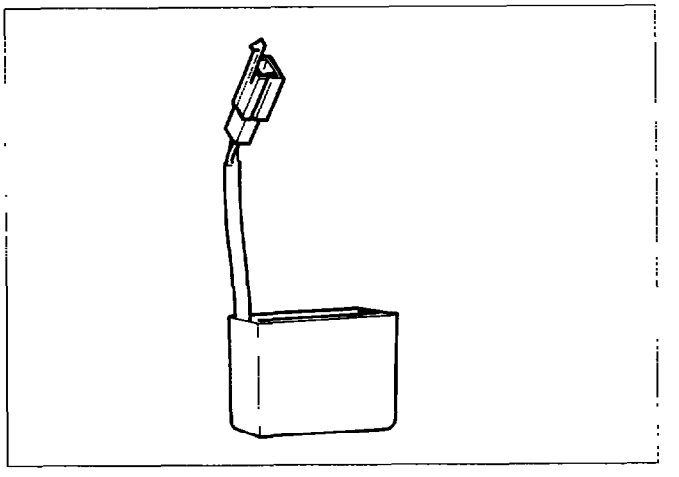


Fig. 9-8

■ If such an instrument is unavailable, the condenser can be checked by replacing with a new one. If the generator performs good with new condenser, the cause of trouble is defect in original condenser.

9-5 DIODE RECTIFIER

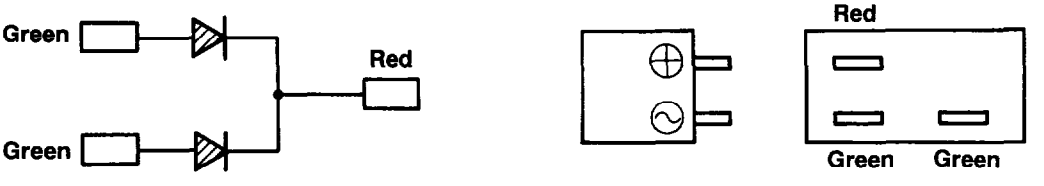


Fig. 9-9

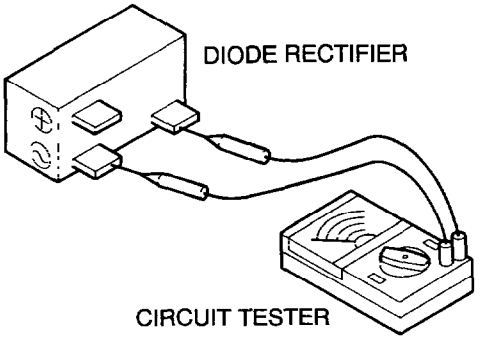


Fig. 9-10

The internal circuit of the diode rectifier is as shown in Fig. 9-9.
Check continuity between each terminal using a circuit tester as shown in Fig. 9-10.

■ Checking table for analogue circuit tester.

Analogue circuit tester		Apply black ⊖ needle of the circuit tester		
		Green	Green	Red
Apply red ⊕ needle of the circuit tester	Green		No continuity	No continuity
	Green	No continuity		
	Red	Continuity	Continuity	

Table 9-2-1

■ Checking table for digital circuit tester.

Digital circuit tester		Apply red ⊕ needle of the circuit tester		
		Green	Green	Red
Apply black ⊖ needle of the circuit tester	Green		No continuity	No continuity
	Green	No continuity		
	Red	Continuity	Continuity	

Table 9-2-2

NOTE 1: Because of the difference of measuring method between the analogue circuit tester and the digital circuit tester, polarity of tester needles should be reversed.

NOTE 2: "Continuity" means forward direction characteristics of the diode, and different from short circuit condition (in which a pointer of the tester goes out of its normal scale), shows resistance to some extent. When result of the checking indicates failure even in one section,replace with a new one.

NOTE 3: "Simpson" brand analogue testers have the characteristic as same as the digital circuit tester.

10. DISASSEMBLY AND ASSEMBLY

10-1 PREPARATION and PRECAUTIONS

1) Be sure to memorize the location of individual parts when disassembling the generator so that the generator can be reassembled correctly. Tag the disassembled part with the necessary information to facilitate easier and smoother reassembling.
2) For more convenience, divide the parts into several groups and store them in boxes.
3) To prevent bolts and nuts from being misplaced or installed incorrectly, place them temporarily back at their original position.
4) Handle disassembled parts with care; clean them before reassembly using a neutral cleaning fluid.
5) Use all disassembly, assembly tools properly, and use the proper tool for each specific job.

10-2 DISASSEMBLY PROCEDURES

Step	Part to remove	Description	Remarks	Tool
1.	Side cover	(1) Remove the side cover by unscrewing four M5 × 8 screws. (See Fig. 10-1.)		(+) Plus screw driver
2.	Rear cover	(1) Remove the rear cover by unscrewing three M5 × 8 screws and two M8 × 10 screws. (See Fig. 10-2.)		(+) Plus driver

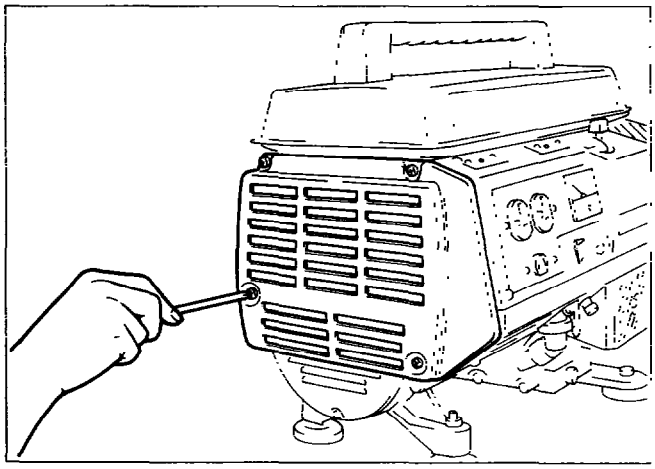


Fig. 10-1

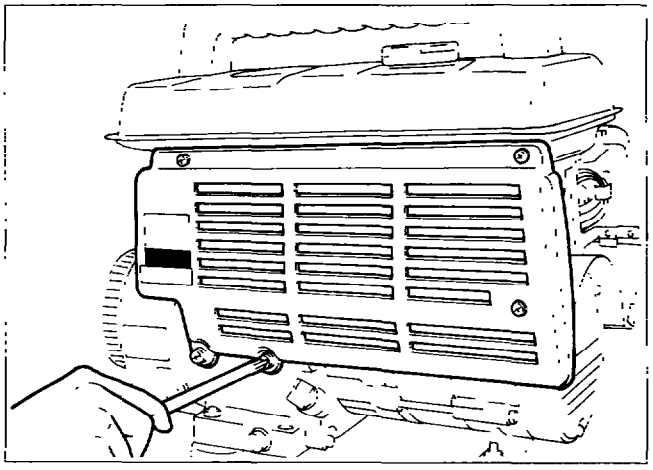


Fig. 10-2

3.	Control panel	(1) Pull the knob off the control lever and remove the control panel by unscrewing four M5 × 8 screws. (See Fig. 10-3.)		(+) Plus driver

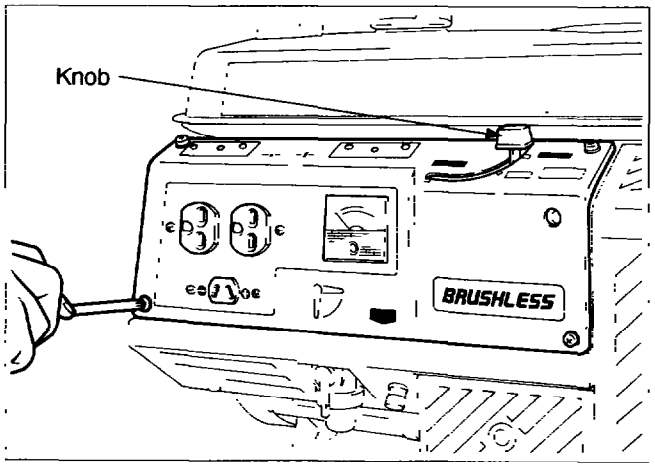


Fig. 10-3

Step	Part to remove	Description	Remarks	Tool
4.	Couplers and plugs (Disconnection)	(1) Disengage the couplers of stator wires from the wires of control panel. 6P couplers (Yellow, Red, Green/Yellow, Brown, White) (See Fig. 10-4.)	Pull the couplers while pushing the locking hook.	
		(2) Disengage the connectors of grounding wire. Pin terminal (Green/Yellow) (See Fig. 10-5.)		

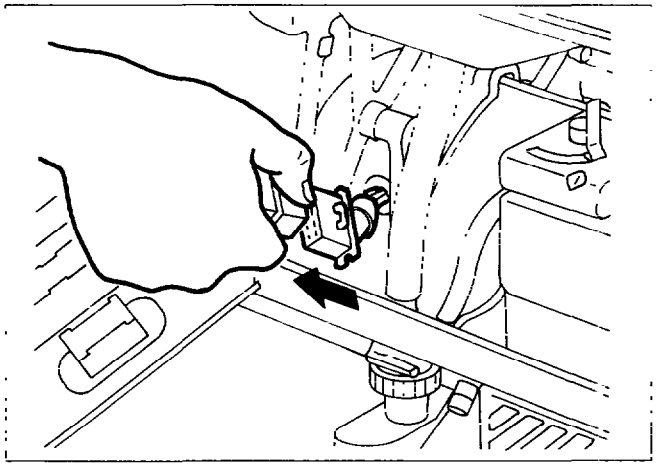


Fig. 10-4

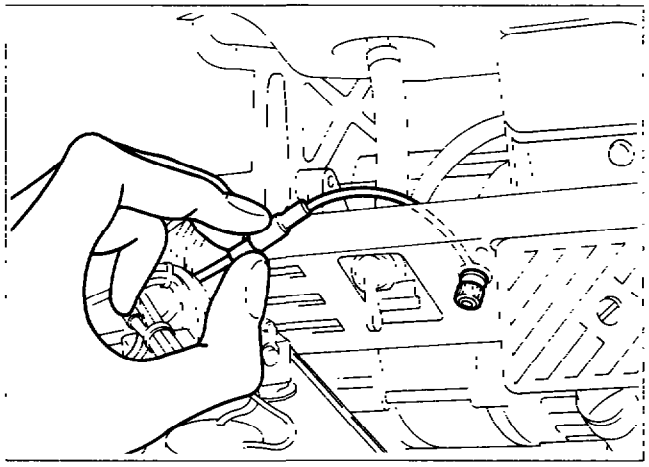


Fig. 10-5

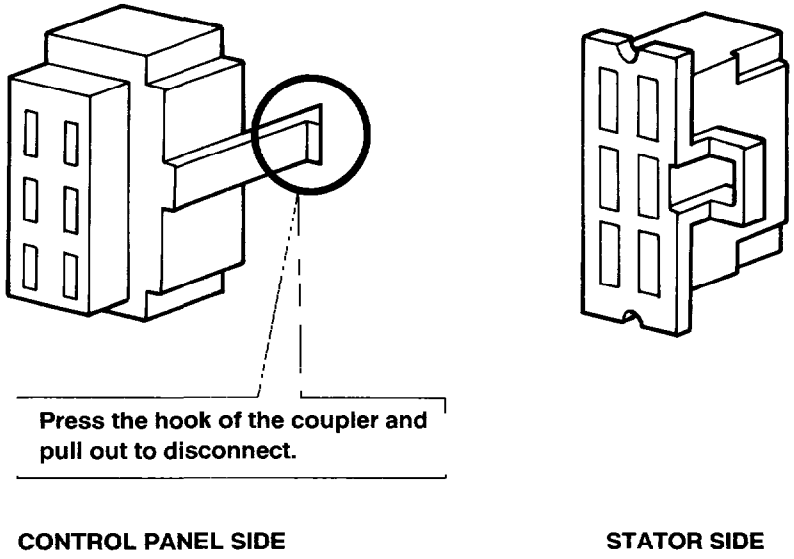


Fig. 10-6

Step	Part to remove	Description	Remarks	Tool
5.	Front cover	(1) Remove the element cover by unscrewing M6 × 12 screw. (See Fig. 10-7.)		(–) Driver
		(2) Remove the front cover by unscrewing three M5 × 8 screws. (See Fig. 10-8.)		(+) Driver

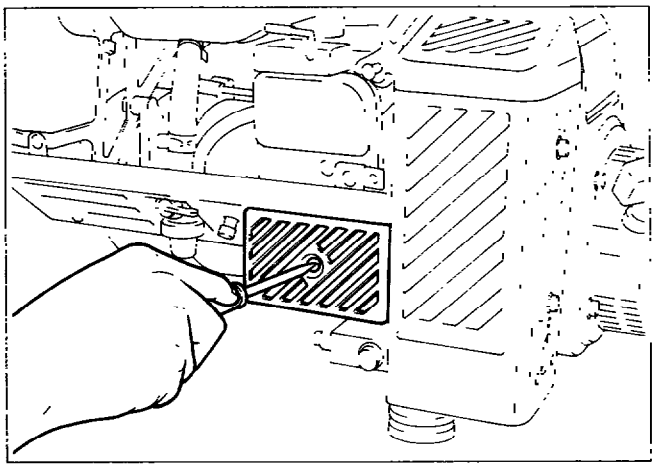


Fig. 10-7

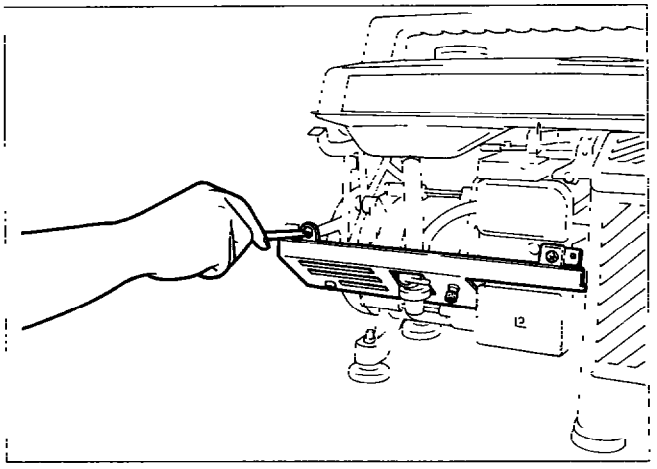


Fig. 10-8

6.	Fuel pipe and plug (Discon-nection)	(1) Discharge fuel from the tank. 1. Shut the fuel striner. 2. Remove the strainer cup. 3. Put a vessel to receive fuel under the strainer and open the fuel cock to discharge fuel. (See Fig. 10-9.) 4. Attach the strainer cup to the strainer body	Use utmost care about fire hazard. Wipe off spilt fuel throughly. Do not lose the filler screen.	
		(2) Disconnect fuel hose from the strainer. Loosen the hose clamp on top of the strainer and pull out the fuel hose from the strainer. (See Fig. 10-10.)		Pliers

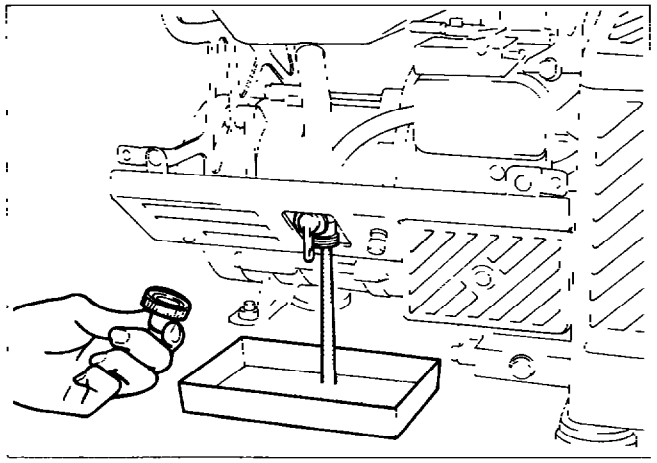


Fig. 10-9

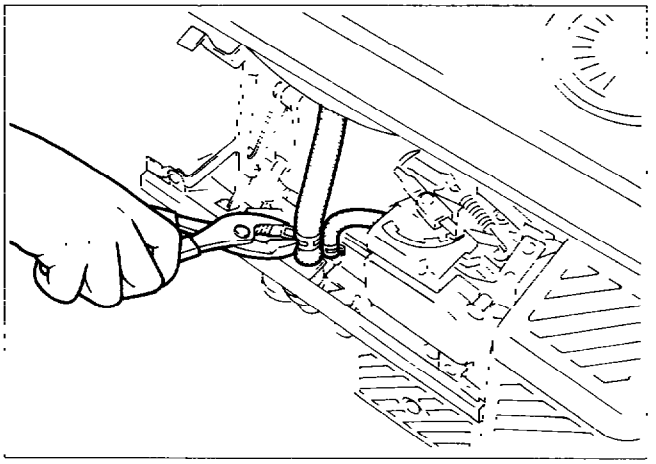


Fig. 10-10

Step	Part to remove	Description	Remarks	Tool
7.	Fuel tank handle	(1) Remove the handle cover by unscrewing the two M3 ×10 screws. (2) Pull off the breather pipe. (3) Remove the handle body by taking off the two M8 nuts.	The fuel tank can be removed without disassembling the handle.	(+) Driver 13mm box wrench

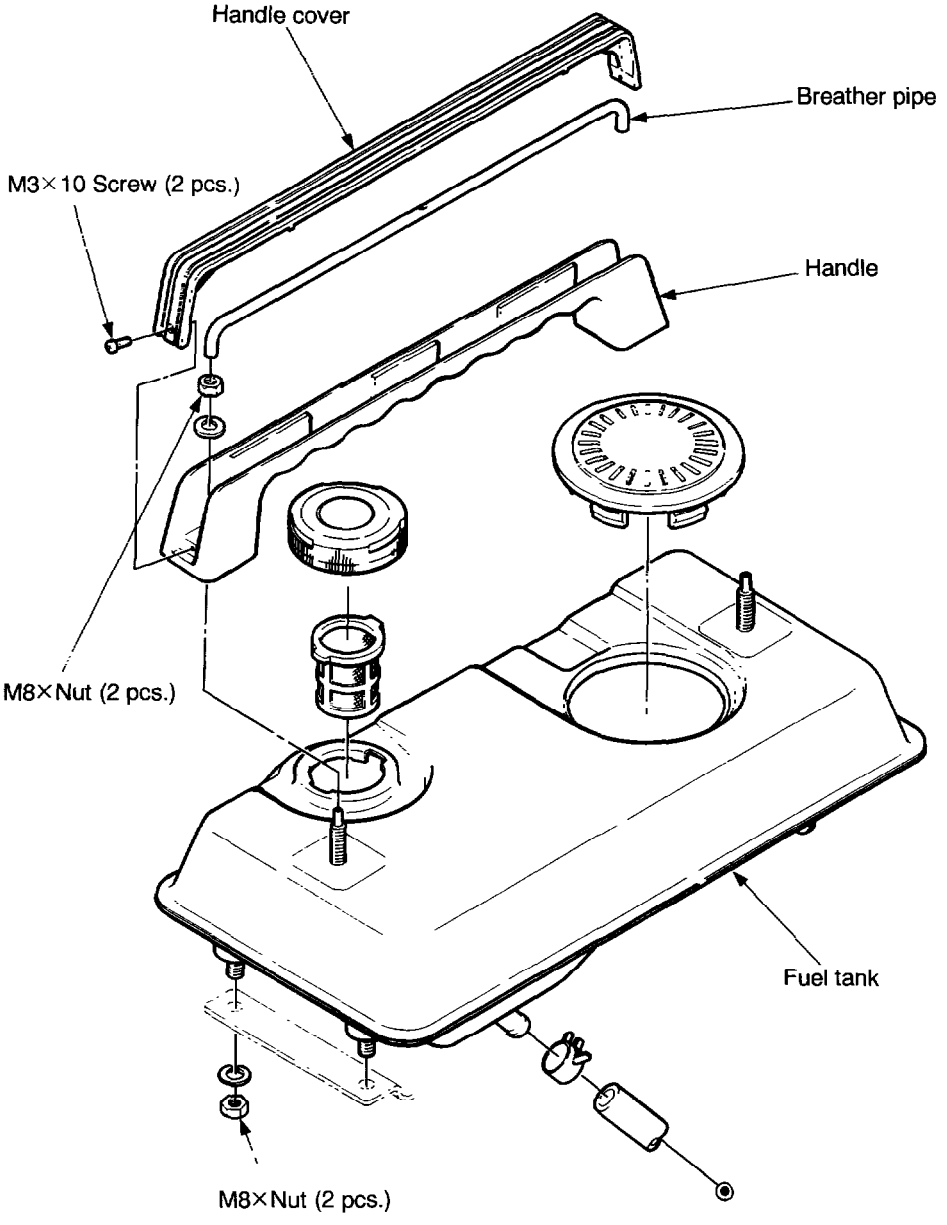


Fig. 10-11

Step	Part to remove	Description	Remarks	Tool
8.	Fuel tank	(1) Remove the two M6×12 flange bolts from the blower housing. (See Fig. 10-12.) (2) Remove the fuel tank by taking off the two M8 nuts from the bottom of the tank. (See Fig. 10-13.)		10mm box wrench 13mm box wrench

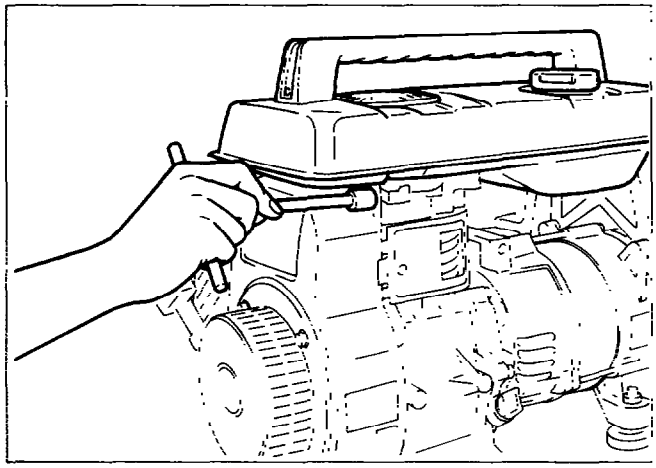


Fig. 10-12

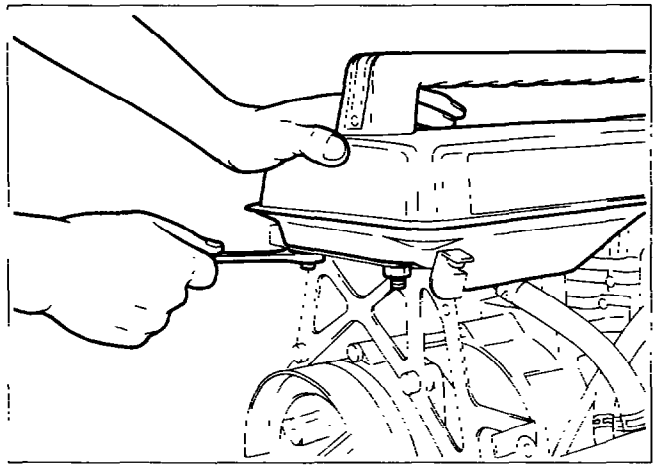


Fig. 10-13

9.	Bracket (Cover)	(1) Remove the bracket cover from the generator by loosening the two M8 × 30 bolts. (See Fig. 10-14.)		13mm box wrench
10.	End cover	(1) Remove the end cover from the generator by unscrewing the three M4 × 8 screws. (See Fig. 10-14.)		(+) Driver

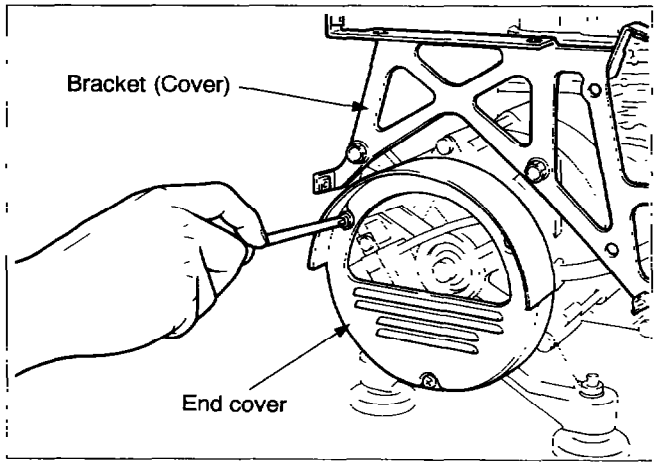


Fig. 10-14

Step	Part to remove	Description	Remarks	Tool
11.	Rear bracket	(1) Loosen and take out the three M6 bracket bolts. (See Fig. 10-15.)		10mm box wrench
		(2) Remove condenser from rear bracket.		Box spanner
		(3) Remove the connector of the diode rectifier and then remove the earth cable terminal from the rear bracket. (See Fig. 10-16.)		Box spanner and screw driver (+)

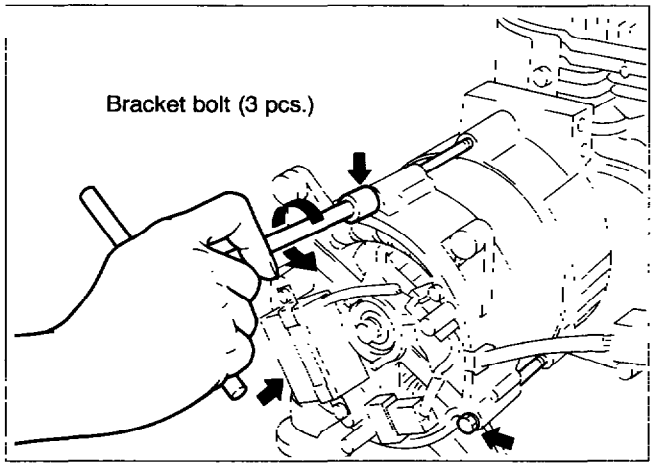


Fig. 10-15

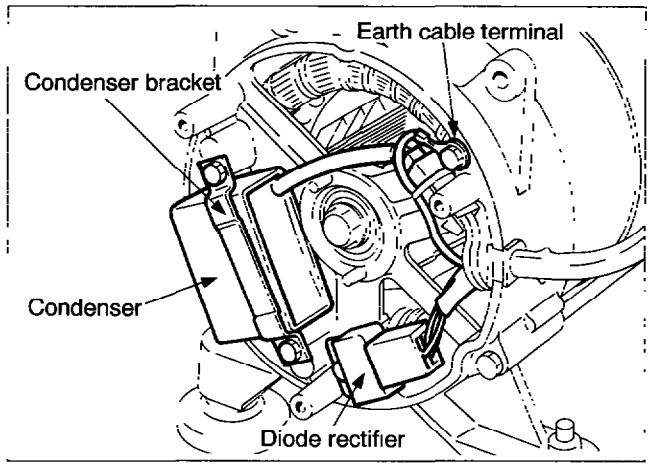


Fig. 10-16

		(4) Remove the rear bracket, tapping it evenly with a plastic mallet. (See Fig. 10-17.)		Plastic mallet
		(5) Remove mount rubbers from rear cover. (See Fig. 10-18.)		Wrench

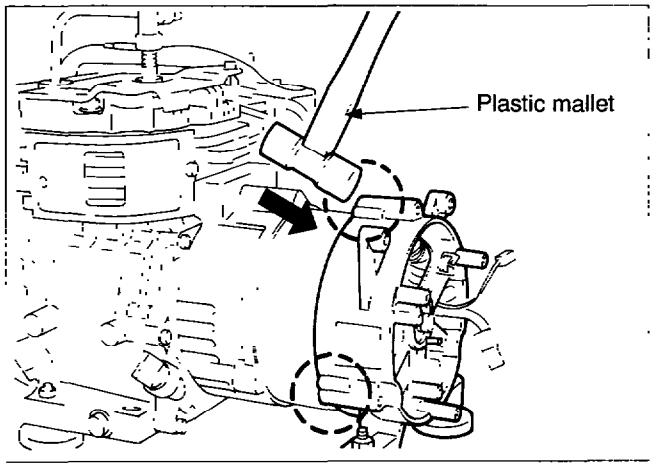


Fig. 10-17

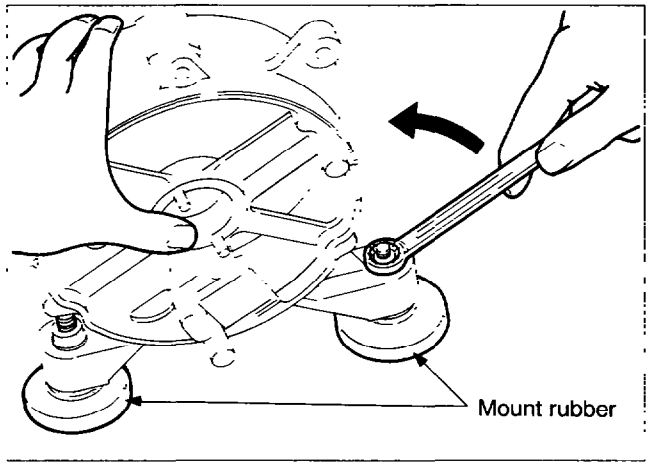


Fig. 10-18

Step	Part to remove	Description	Remarks	Tool
12.	Stator	(1) Remove the stator cover. (See Fig. 10-19.) (2) Pull off the stator from the front cover tapping the core with a plastic mallet. (See Fig. 10-20.)	Never tap on the winding and the lead.	Plastic mallet

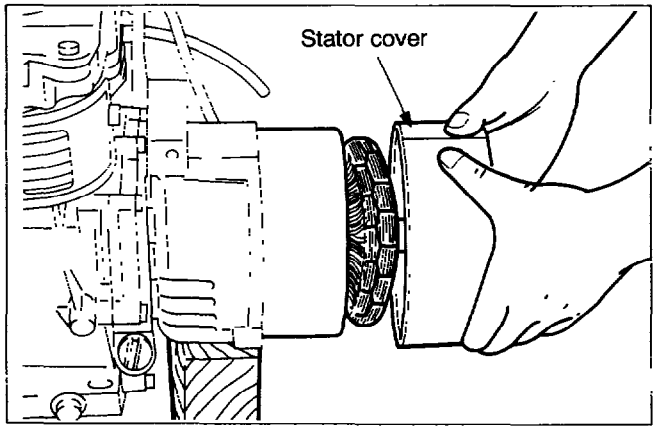


Fig. 10-19

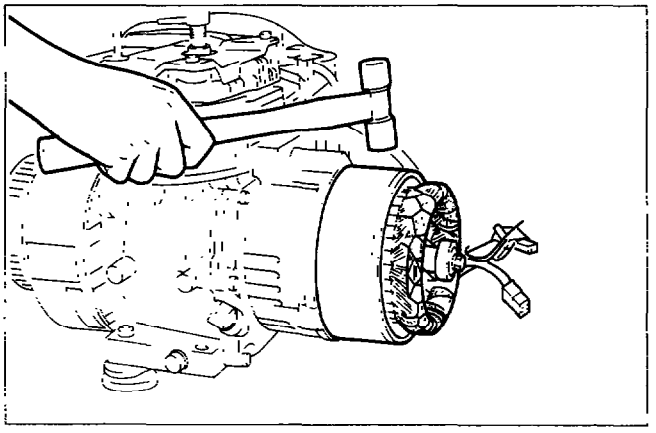


Fig. 10-20

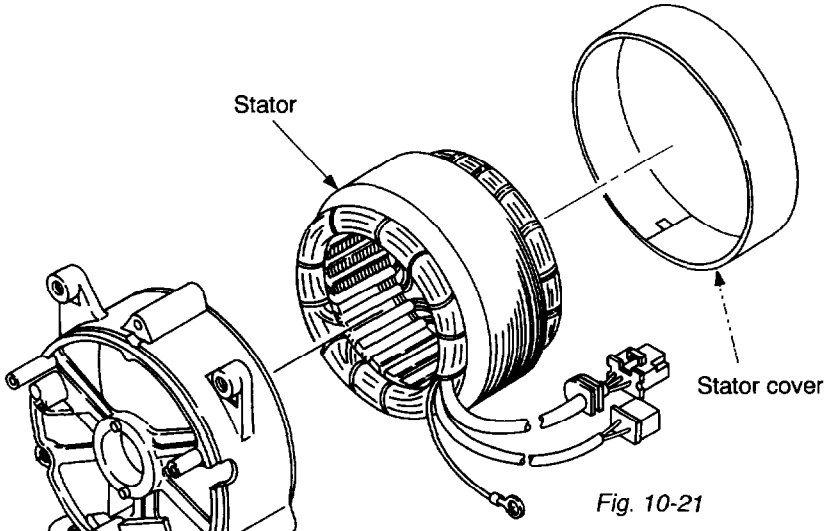


Fig. 10-21

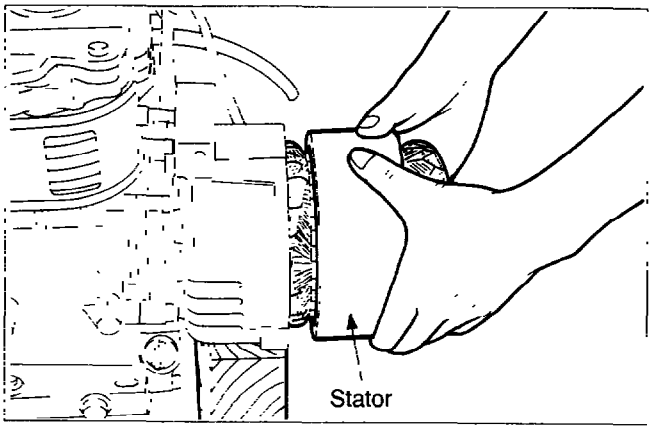


Fig. 10-22

Step	Part to remove	Description	Remarks	Tool
13.	Rotor	(1) Take off the through bolt. Apply a box wrench on the head of through bolt. Hit the wrench handle with a hammer counter-clockwise to loosen.		Box wrench Plastic hammer
		(2) Put the engine on the working table recoil starter side down.		
		(3) Use a bolt and oil as a tool for pulling out rotor in the following procedures : 1. Pour engine oil into the center hole of rotor shaft. Fill with oil to the shaft end. (See Fig. 10-24.) 2. Prepare a bolt with the following thread size : M8 × P 1.25 3. Apply a few turns of seal tape around the tip of the bolt. (See Fig. 10-25.)		

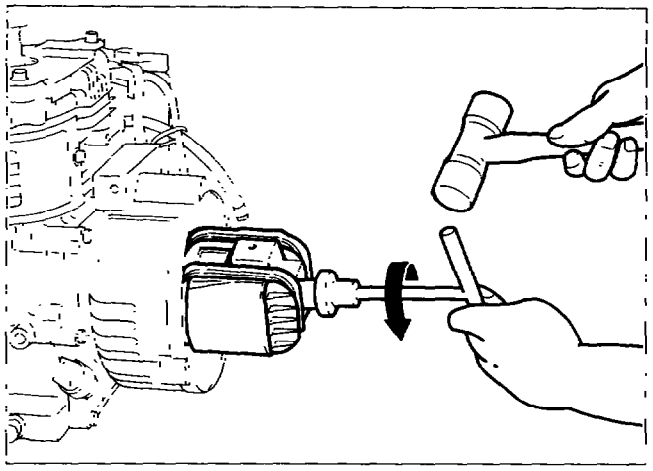


Fig. 10-23

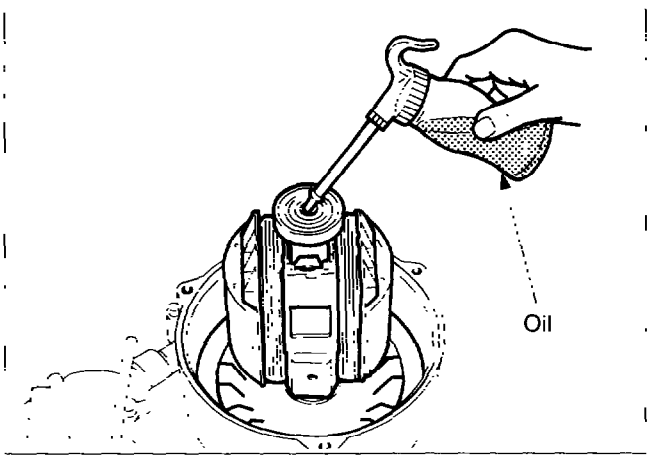


Fig. 10-24

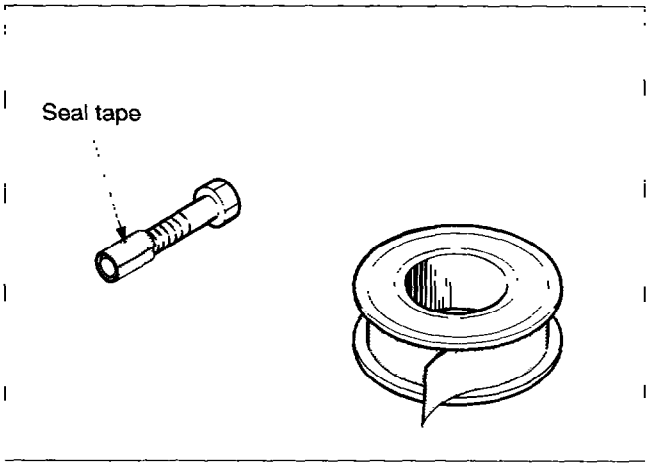
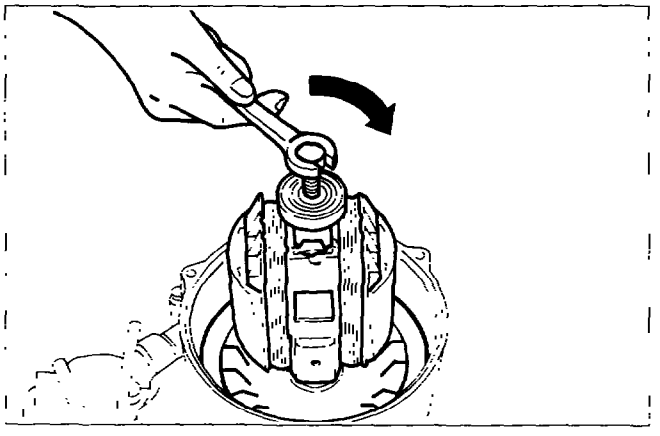
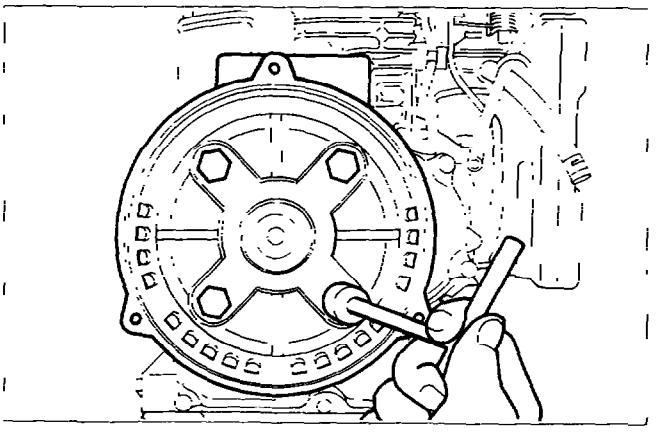


Fig. 10-25

Step	Part to remove	Description	Remarks	Tool
13.	Rotor	4. Screw the bolt into the thread of the rotor shaft. 5. Torque the bolt using a socket wrench until the rotor comes off loose. * The hydraulic pressure inside the rotor shaft takes apart the rotor from the engine shaft.		Socket wrench
		(4) Wipe off oil throughly from rotor shaft and engine PTO shaft.  *Fig. 10-26*		
14.	Front bracket	(1) Remove the front bracket, which is mounted on the main bearing cover of the engine, by taking out four M8 × 18 bolts. (See Fig. 10-27.)  *Fig. 10-27*		13 mmbox spanner

Step	Part to remove	Description	Remarks	Tool
15.	Mount rubbers	(1) Remove mount bracket from engine. Remove mount rubbers from mount bracket. 8 ϕ Nut : 3pcs. or 2pcs.		12 mm wrench

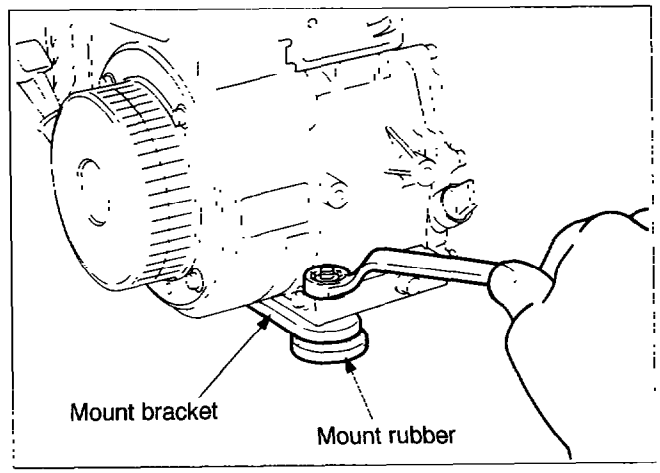


Fig. 10-28

10-3 ASSEMBLY PROCEDURES

10-3-1 FRONT BRACKET

Install the front bracket on the main bearing cover of the engine, engaging the faucet joint.
(See Fig. 10-29.)

M8 × 20mm bolt and washer ass'y ····· 4pcs.

TIGHTENING TORQUE		
120	~	140 kg • cm
1175	~	1370 N • cm
8.7	~	10.1 ft • lbs.

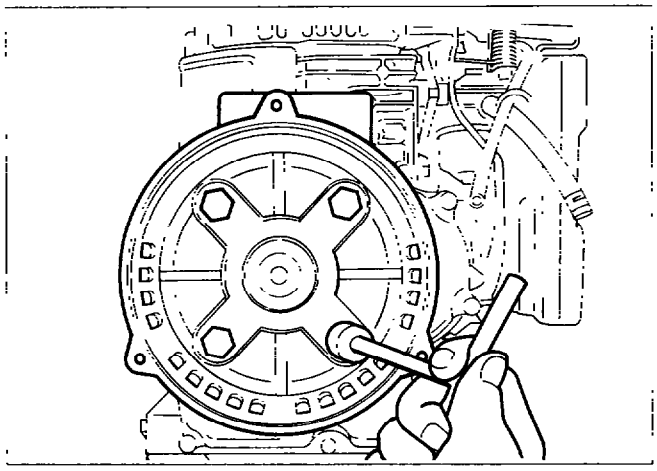


Fig. 10-29

10-3-2 ROTOR

1) Wipe off oil from the tapered portion of engine shaft and matching tapered hole of rotor shaft. (See Figs. 10-30 and 10-31.)

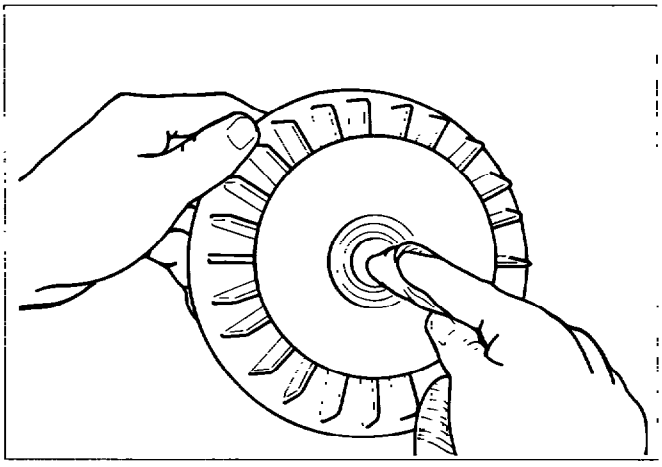


Fig. 10-30

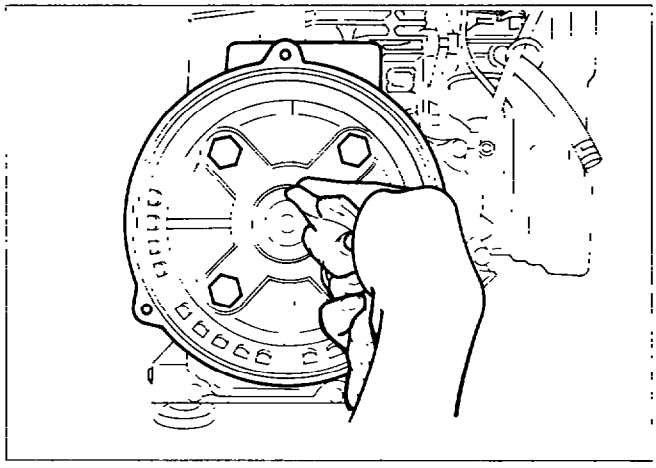


Fig. 10-31

2) Install rotor on the engine shaft and tighten the through-bolt.
Apply a wrench on the head of through bolt and hit wrench handle clockwise with a hammer to tighten. (See Fig. 10-32.)
If an impact wrench is available, use it.

TIGHTENING TORQUE		
120	~	140 kg • cm
1175	~	1370 N • cm
8.7	~	10.1 ft • lbs.

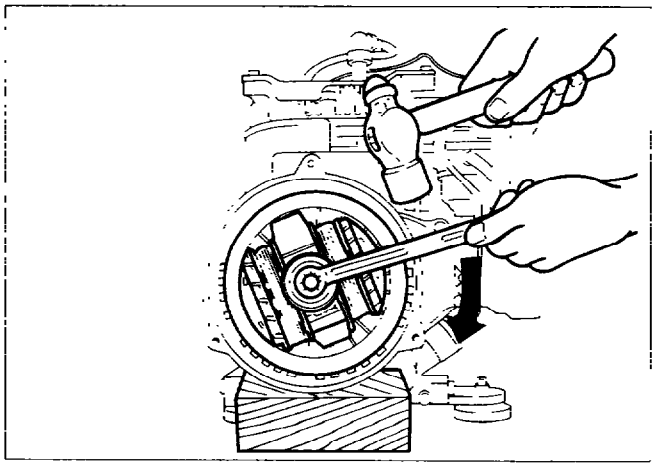


Fig. 10-32

10-3-3 STATOR

(1) Holding the rear bracket and stator, fit them to the front bracket. Match the mounting hole of the rear bracket and that of the rotor bearing, and softly strike the outside periphery of the rear bracket with a plastic hammer. (See Fig. 10-33.)

(2) Attach the stator cover around the stator.

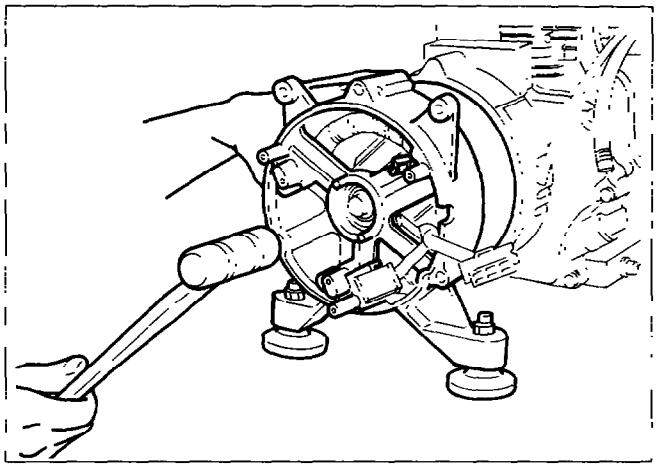


Fig. 10-33

(3) Tighten the three M6 bolts to fix the rear bracket to the front bracket .

TIGHTENING TORQUE (Rear bracket)			
55	~	75	kg • cm
535	~	735	N • cm
4.0	~	5.4	ft • lbs.

(4) Put the grommet in the groove of the rear bracket and secure the wire.

Note : Fix the wire from the stator and diode stack with the clamp at the bottom of the groove.

10-3-4 CONDENSER

Put condenser to rear cover.

5 ø × 10 mm tapping screw ..... 2 pcs.

TIGHTENING TORQUE			
33	~	55	kg • cm
325	~	535	N • cm
2.4	~	4.0	ft • lbs.

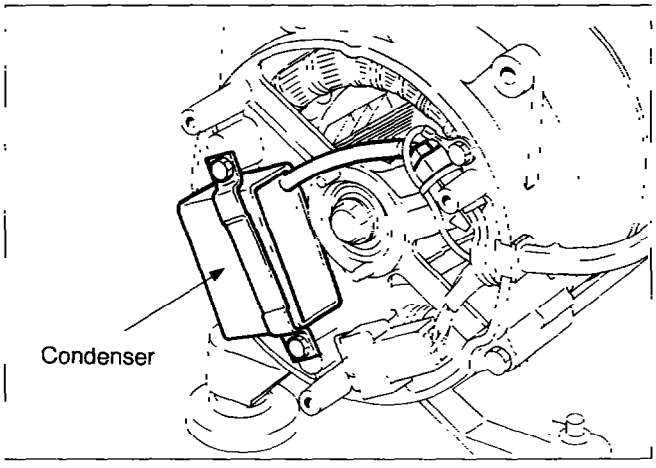


Fig. 10-34

10-3-5 END COVER

Set the end cover on the rear bracket with three M4 ×8 screws.

10-3-6 BRACKET (COVER)

Mount the bracket (cover) on the rear bracket and secure them with M8 ×30 bolts.

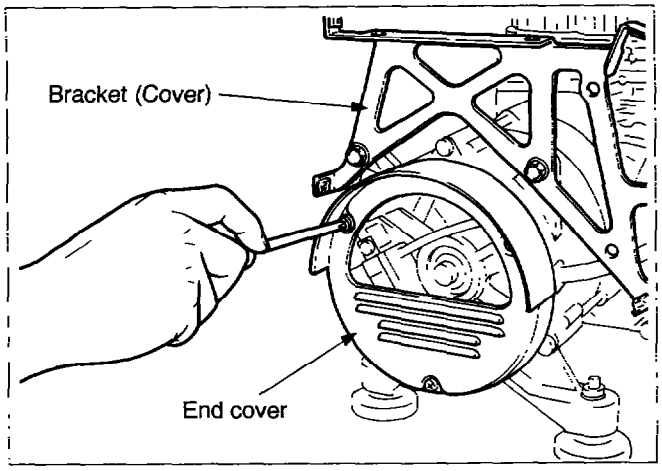


Fig. 10-35

10-3-7 FUEL TANK AND FUEL PIPE (CONNECTION)

(1) Connect the rubber pipe to the engine carburetor and fasten it with a hose clamp, Attach the banjo to the opposite end of the rubber pipe, tighten it with a hose clamp, and fasten the pipe to the fuel strainer with the banjo bolt.

Note : Mount the fuel strainer with the banjo outlet upward.

(2) Fasten the strainer to the front bracket with the joint nuts.
(3) Secure the mounting tab on the bottom of the fuel tank and the blower housing with M6 ×12 bolts. Insert the attaching bolts on the other end of tank into the mount bracket hole and secure it with two M8 nuts.
(4) Connect the rubber pipe
First, fit the hose clamp on the rubber pipe, connect the strainer and fuel tank, then fasten the rubber pipe with the hose clamps.

Note : Apply a drop of oil to the rubber pipe so that it may easily be connected to the strainer and the fuel tank.

10-3-8 FUEL TANK HANDLE

(1) Match the handle hole with the bolt on the top of the fuel tank and secure it with M8 nuts.
(2) Completely insert the breather pipe over the bolt.

Note : There is a hole at the center of the breather pipe for air bleeding. Set the breather pipe so that the hole is directed upward.

(3) Fix both ends of the handle cover with M3 ×10 screws.

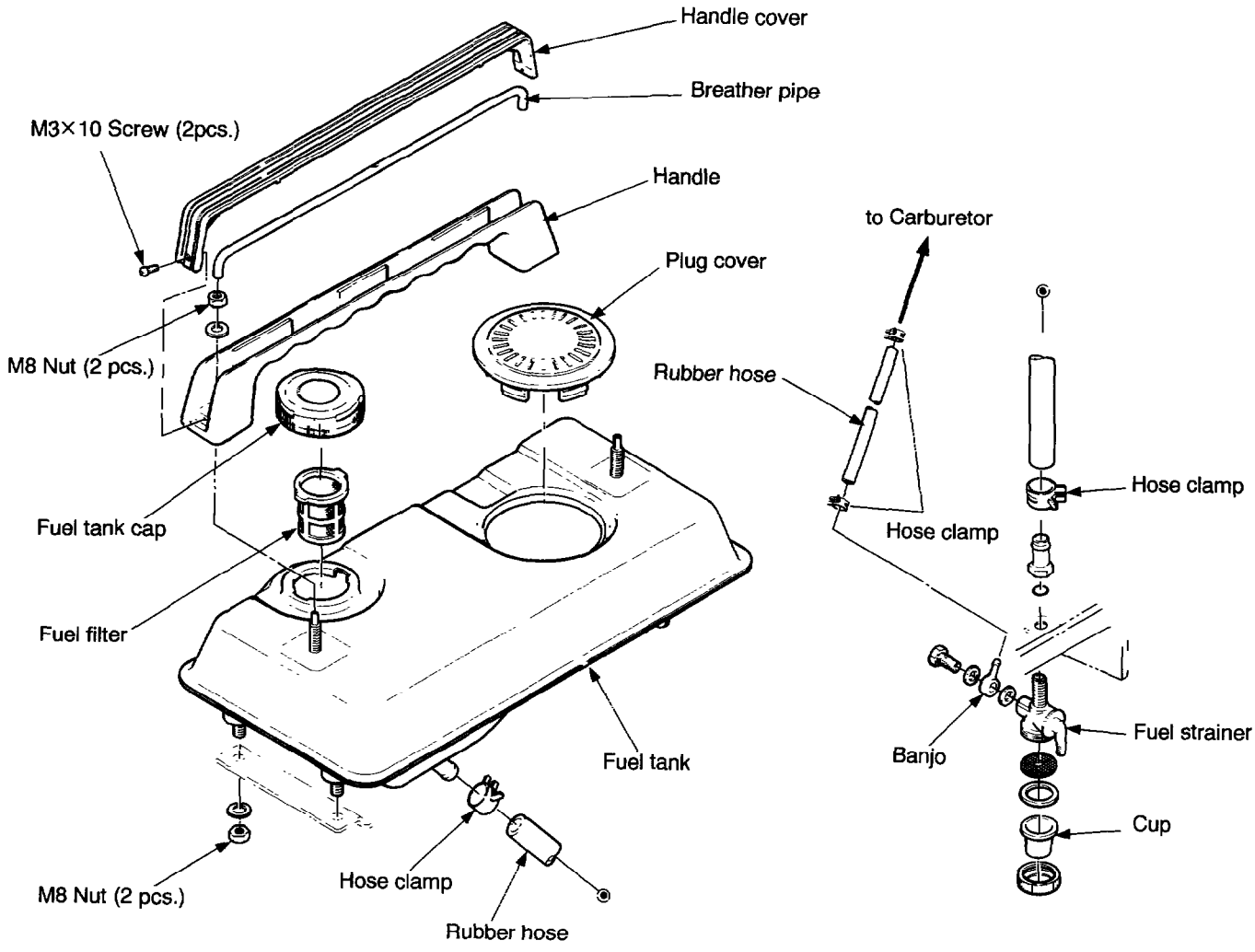


Fig. 10-36

10-3-9 FRONT COVER AND ELEMENT COVER

(1) Secure the front cover, on which fuel strainer have been mounted, with three M5 ×8 screws. (See Fig. 10-37.)

(2) Secure the element cover with M6 ×12 screws. (See Fig. 10-38.)

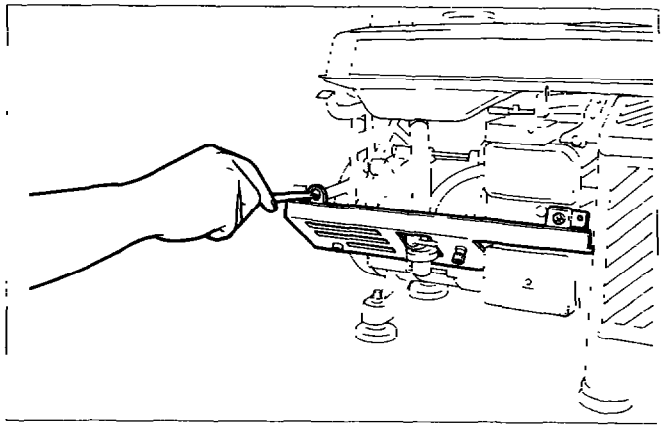


Fig. 10-37

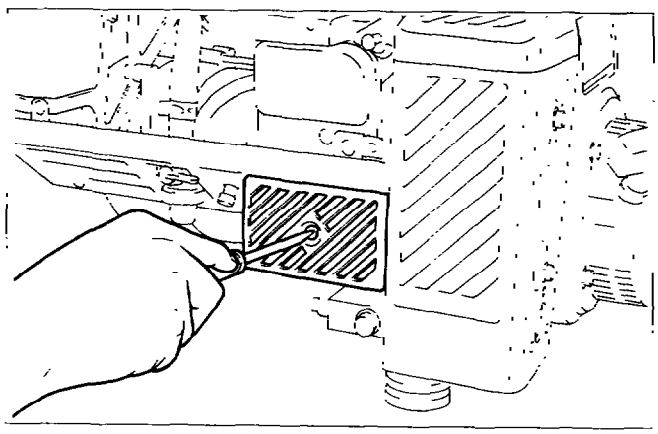


Fig. 10-38

10-3-10 CONNECTION OF WIRES

(1) Connect the wires drawn out from the stator to the wires from the control box. (See Fig. 10-39.)
(2) Press the couplers until the locking hook engages securely.
(3) Connect the grounding wire. (See Fig. 10-40.)

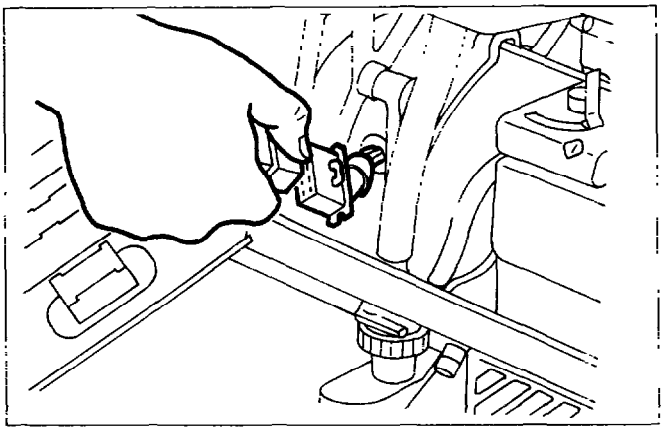


Fig. 10-39

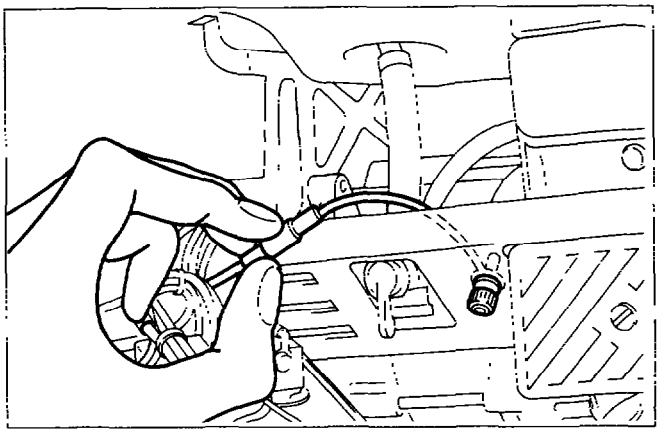
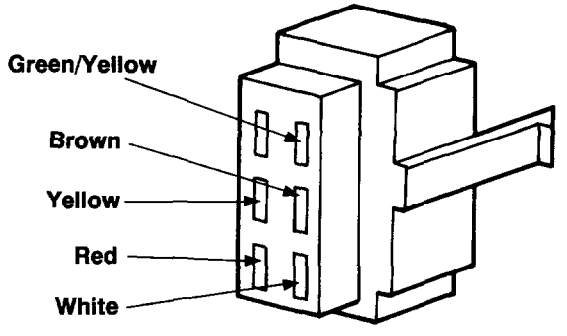


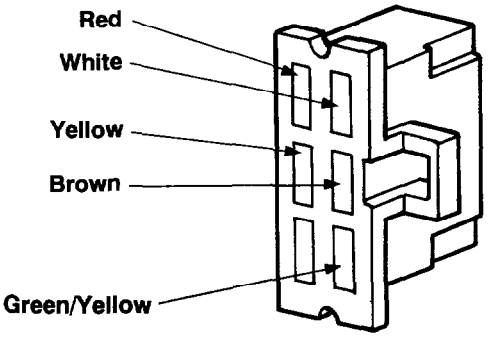
Fig. 10-40

[WIRE CONNECTIONS BETWEEN CONTROL PANEL AND STATOR]

6P coupler Wire color : Yellow, Red, Green/Yellow, Brown, White



CONTROL PANEL SIDE



STATOR SIDE

● Earth (Ground) wire : Pin terminal Wire color : Green/Yellow

10-3-11 CONTROL PANEL

(1) Put the control panel over the control lever and secure it with four M5 screws.
(2) Attach the knob to the control lever.

Note : After the couplers and connectors have been connected and secured to the control panel, secure the wires with a wire band to the control panel.

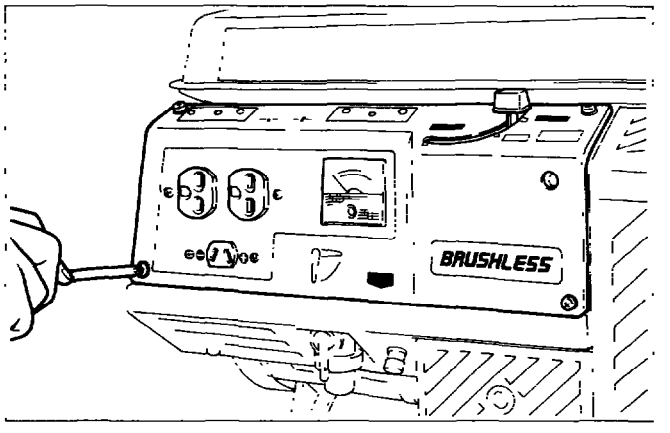


Fig. 10-41

10-3-12 REAR COVER

Secure the rear cover with three M5×8 screws and two M8 ×10 screws.

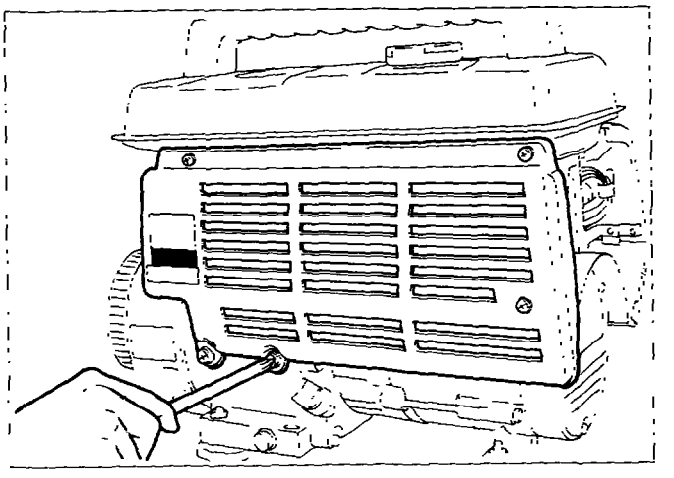


Fig. 10-42

10-3-13 SIDE COVER

Secure the side cover with four M5×8 screws.

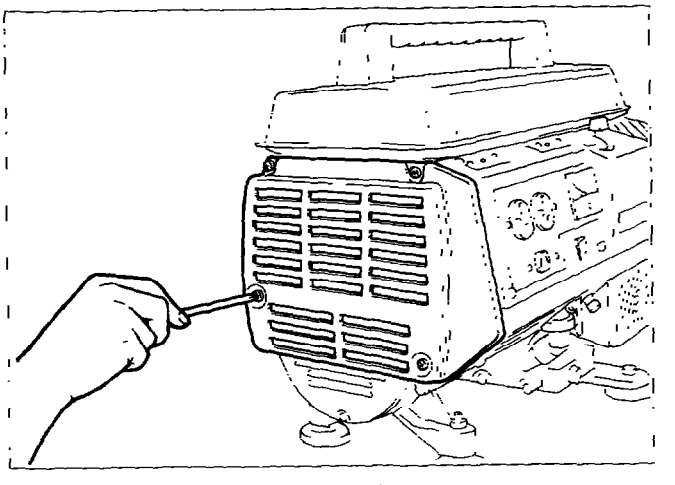


Fig. 10-43

11. TROUBLESHOOTING

11-1 NO AC OUTPUT

11-1-1 CHECKING STATOR

- Remove control panel and disconnect couplers on wiring.
- Measure the resistance between terminals on stator leads.
  Refer to Table 9-1 on page 24 for normal resistance.

[Remedy]

If stator is defective, replace with new one.

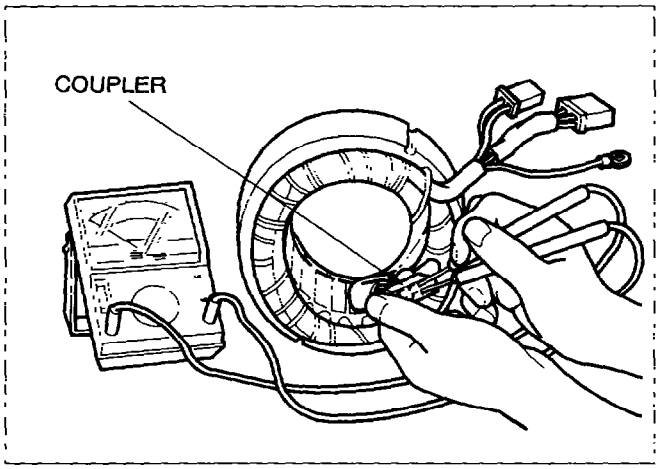


Fig. 11-1

11-1-2 CHECKING CONDENSER

- If an instrument (Q.C.-meter or C-meter) for measuring capacity of condenser is available, check the capacity of condenser.

- **NORMAL CAPACITY OF CONDENSER**

CAPACITY
10μF

- If you do not have such an instrument, you can check condenser by replacing with new one and test running.
  If the generator perform normally with new condenser, the cause of trouble is defect in original condenser.

11-1-3 CHECKING ROTOR

- Remove rear cover and stator.

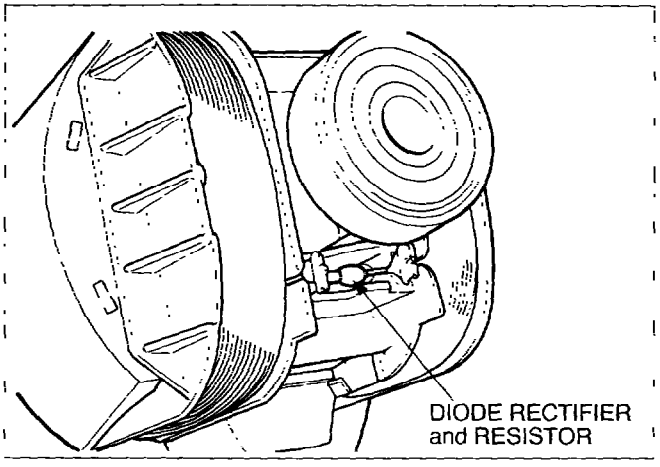


Fig. 11-2

■ Measure the resistance of field coil with a circuit tester. (See Fig. 11-3.)

■ **NORMAL RESISTANCE**

(R × 1Ω ± 10%)

RESISTANCE
8.5 Ω

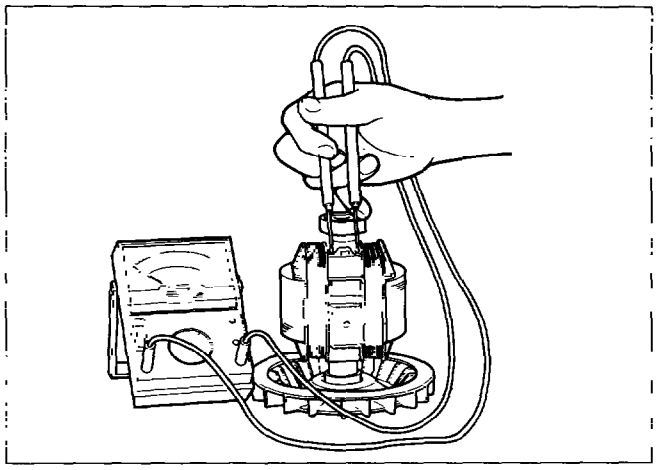


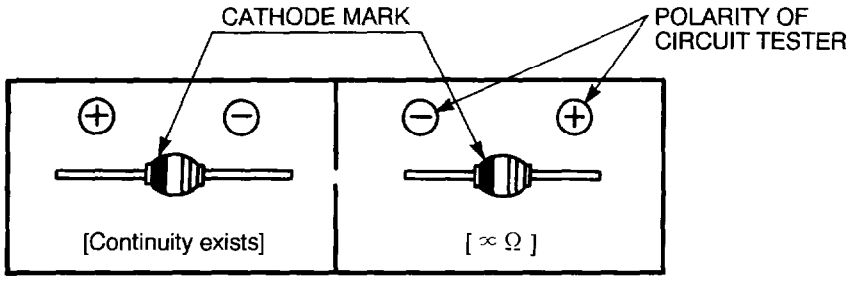
Fig. 11-3

[Remedy]

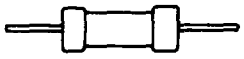
■ If the resistance is not normal, replace rotor with new one.

■ Unsolder and take out the diodes and the resistors.

■ Measure the resistance of 2 pieces of diode.



■ Measure the resistance of each resistor.



NORMAL RESISTANCE
15 KΩ

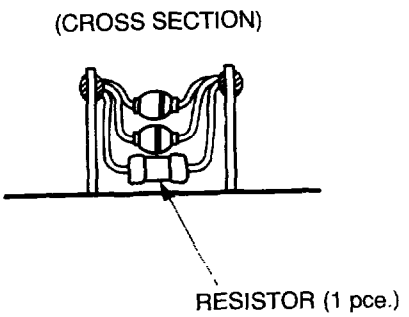
■ Check the magnetic force of magnets molded in the rotor.

[Remedy]

1. If the magnetic force is weak, replace the rotor with a new one.
2. If the diode or the resistor is faulty, replace them with new one. When all these parts are good, assemble them and then solder.

[Reassembling]

1. Place the resistors at the bottom.
2. On the resistors put the diodes, taking care of its polarity.
3. Solder them to the terminal.
   *Resistor has no polarity.



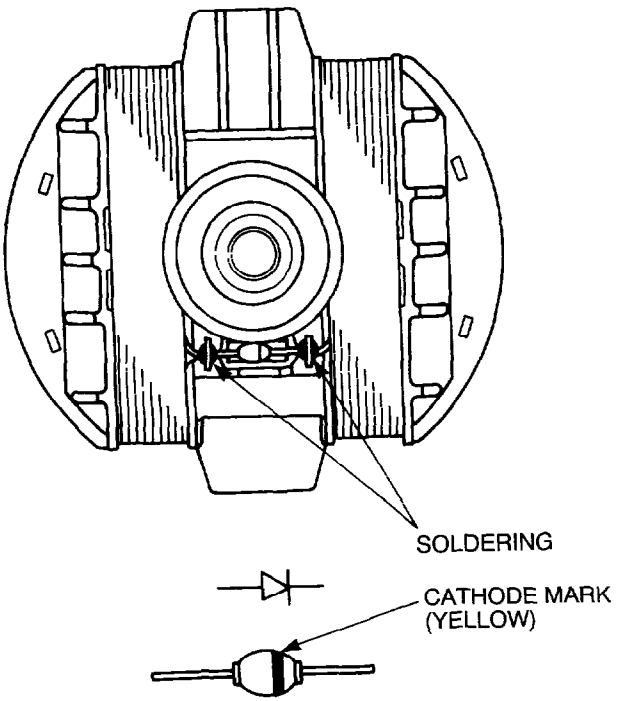


Fig. 11-4

11-2 AC VOLTAGE IS TOO HIGH OR TOO LOW

11-2-1 CHECKING ENGINE rpm .

If the engine rpm is too high or too low, adjust it to the rated rpm .

[How to adjust engine rpm .]

- Loosen the nut on the adjusting screw.
- Turn the adjusting screw clockwise to decrease engine speed or counter-clockwise to increase engine speed.
  Normal engine speed at no load is :
  3150 ~ 3200 rpm for 50 Hz type
  3750 ~ 3800 rpm for 60 Hz type

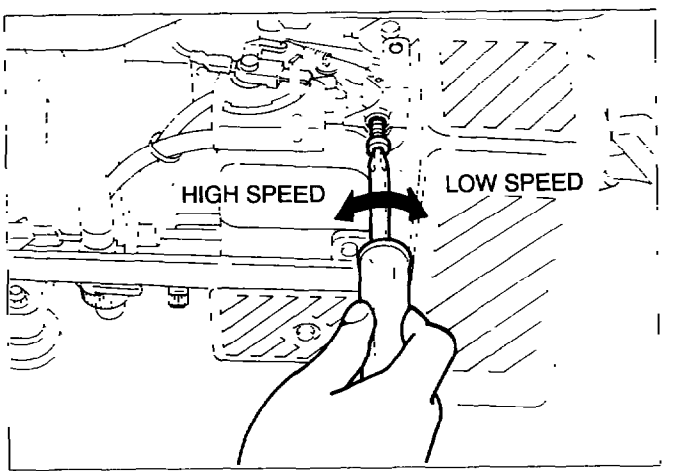


Fig. 11-5

11-2-2 CHECKING STATOR

Check stator referring to Step 11-1-1.

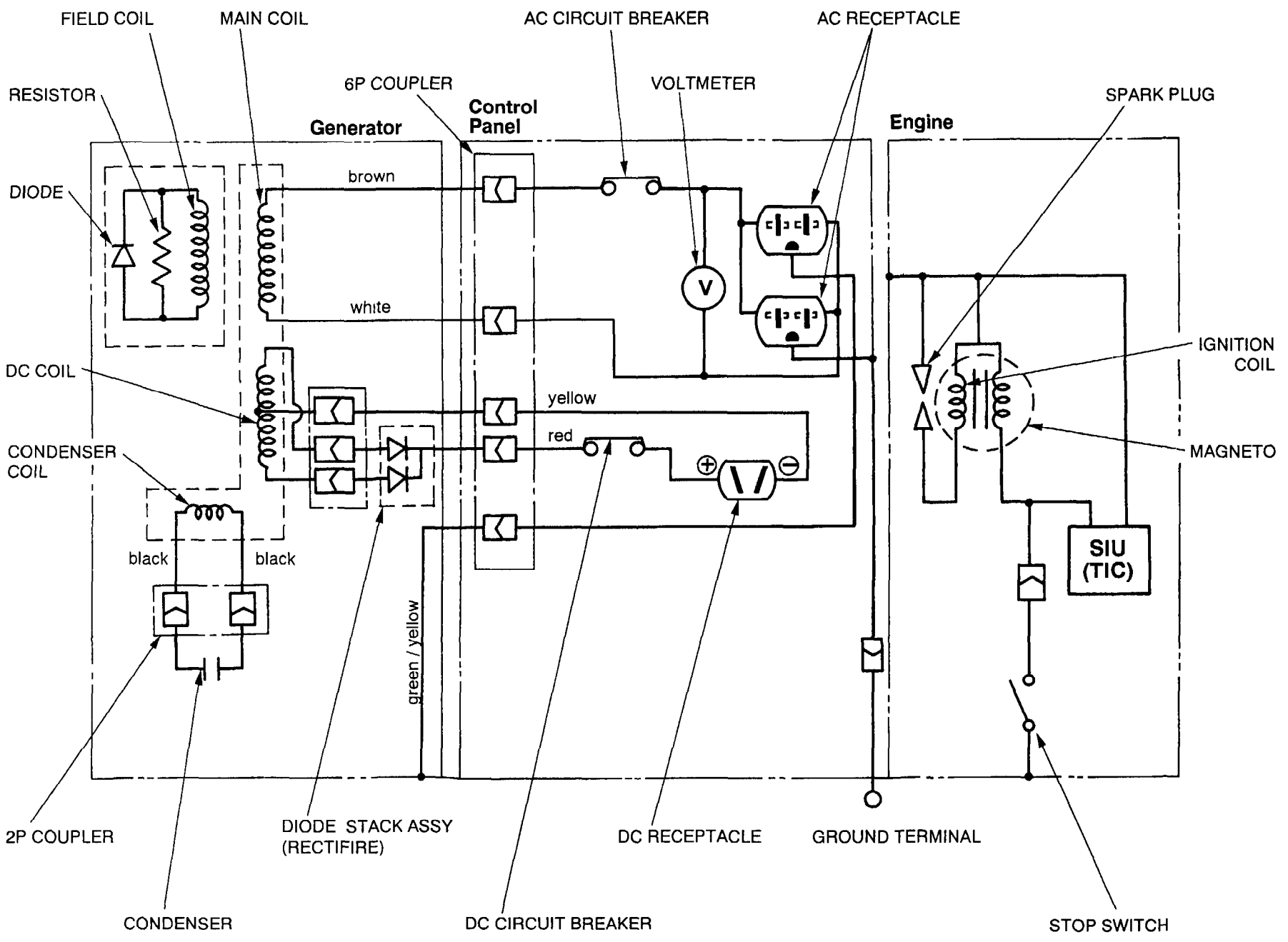
11-2-3 CHECKING CONDENSER

Check condenser referring to Step 11-1-2.

11-2-4 CHECKING ROTOR

Check rotor referring to Step 11-1-3.

12. WIRING DIAGRAM



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